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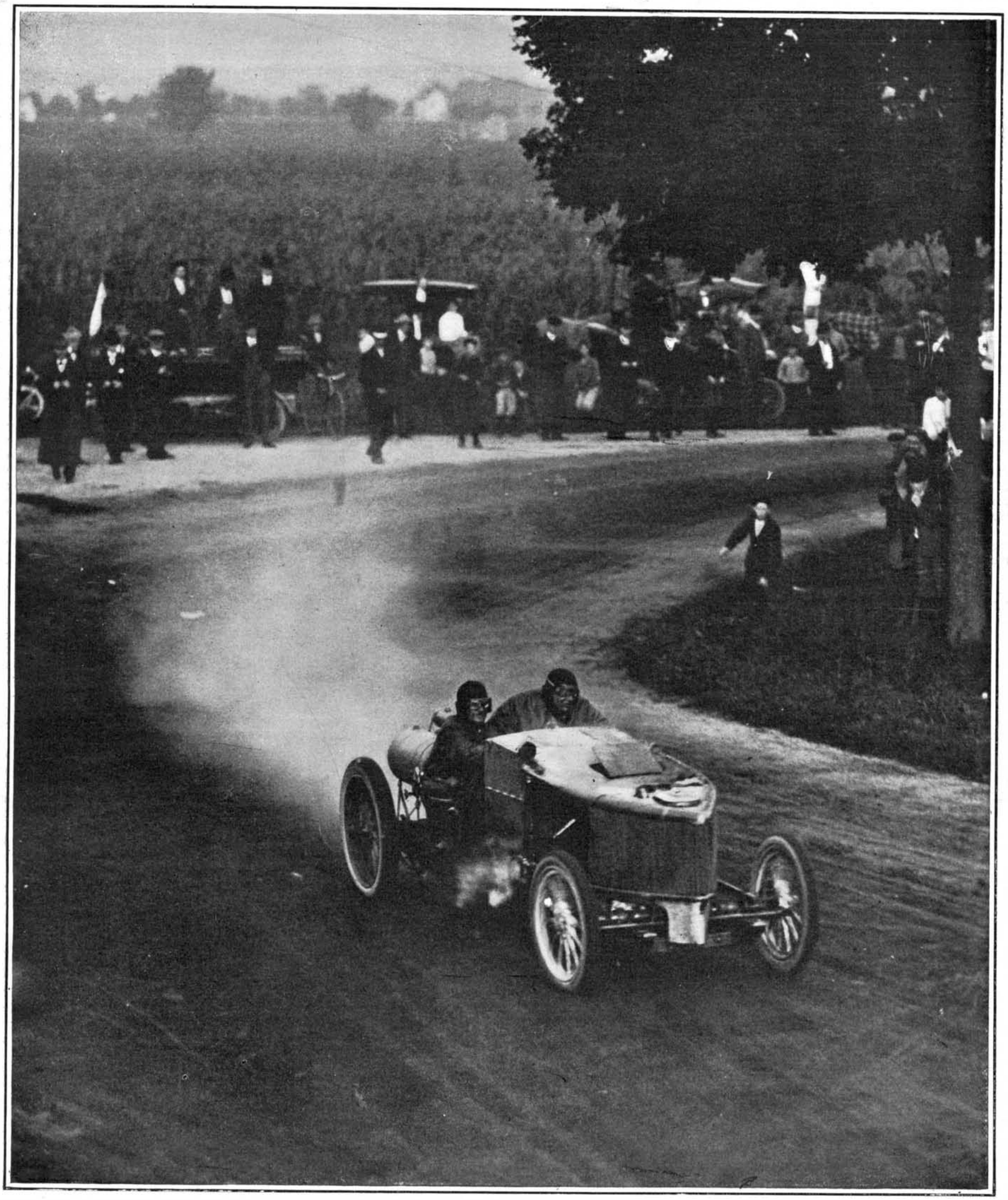
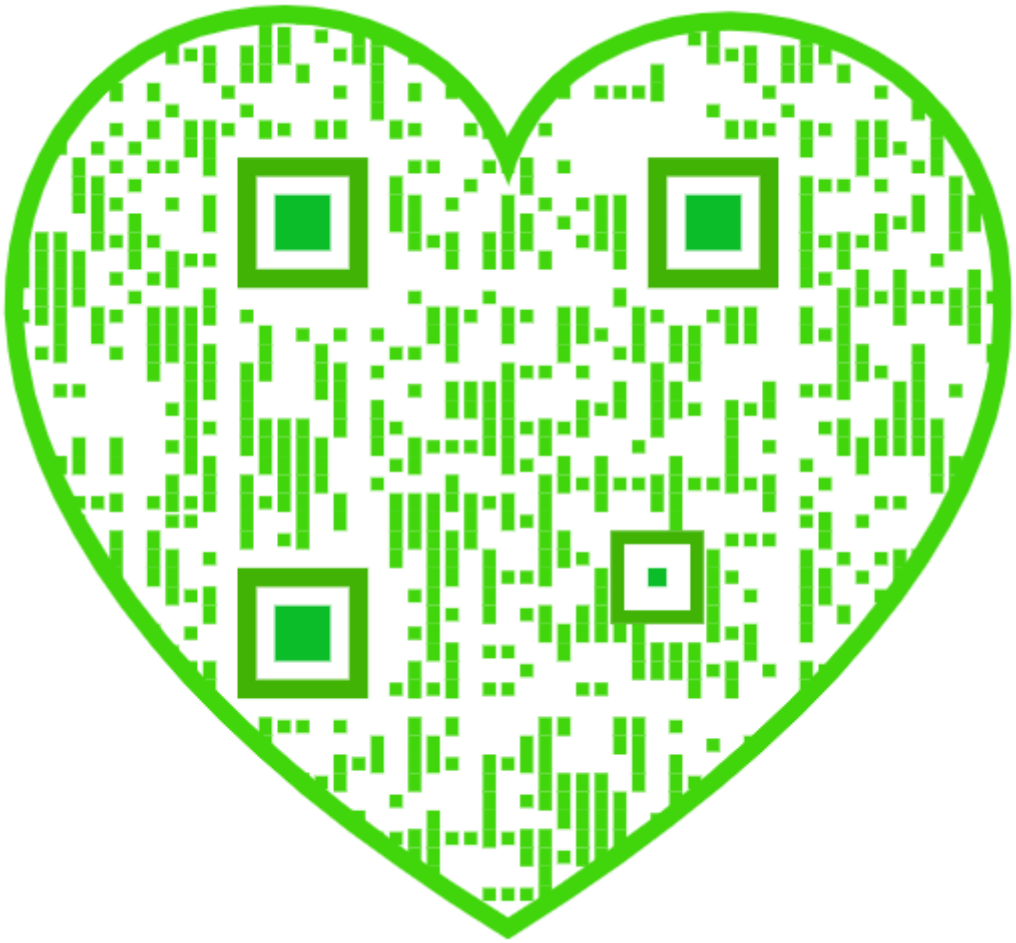


THE 40-HORSE-POWER WHITE STEAM RACER MAKING THE TURN AT HYDE PARK IN THE ELIMINATION TRIAL RACE, TO SELECT CARS FOR THE VANDERBILT CUP RACE, WHICH TAKES PLACE OCTOBER 14, ON LONG ISLAND.—[See page 280.]



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NEW YORK, SATURDAY, OCTOBER 7, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TWO ENGINEERS IN THE CAB.

The time has certainly come for a protest against a certain type of locomotive, or rather against the present way of manning such locomotives, which constitutes a grave peril to the passengers on certain railroads. We refer to what is popularly known as the "Mother Hubbard" type, in which there are two cabs widely separated; one for the engineer, and the other for the fireman. The engineer's cab is located at about the mid-length of the boiler, and the fireman's cab or platform is in the usual position at the rear of the boiler. The only means of access to the engineer's cab, which is entirely inclosed, is by a narrow running board, reaching to the fireman's platform. The firebox is so wide that when the fireman is attending to his duties the engineer is practically shut off from his sight. When we remember that on many of the best managed roads there is a strict law that the fireman shall check off the signals with the engineer, we can see that, on the face of it, this separation of the two men introduces an element of risk in the misinterpretation of signals. But, over and above this is the far more serious risk that the engineer may be suddenly taken sick, or even stricken down in death by apoplexy or heart failure. Cases of the death of the engineer through heart failure or through being hit when leaning out of the cab have happened of late years with inexplicable frequency, and the last case of this kind, which occurred in the middle of last month, strikingly illustrates the dangers inherent in this form of engine. A "Chicago Limited" train, drawn by a locomotive of the "Mother Hubbard" type, was running at high speed in the night time, when the engineer suddenly fell dead in the cab, the fireman being in complete ignorance that anything was wrong. The tragedy was discovered only when the train ran at full speed through a station at which it should have stopped, noticing which, the fireman climbed into the cab, where he found the lifeless body of the engineer and brought the train to a stop. The type of locomotive referred to is a popular one on some lines, and it is an excellent design for the conditions under which it has to work. It has the one defect brought out by the above and similar incidents, the clear remedy for which is to place two men at all times in the cab.

COMPARISON OF TURBINES AND RECIPROCATING MARINE ENGINES IN SERVICE.

The Midland Railway Company has recently been in a position to gather what is undoubtedly the most valuable comparative data as yet secured, as to the relative performance of turbine and reciprocating engines when used in commercial service. The company recently built for their Irish and Isle of Man service four steamers, which were identical in everything but their motive power. This, in the case of two of them, the "Antrim" and "Donegal," consisted of reciprocating engines, and in the case of the others, the "Londonderry" and the "Manxman," consisted of Parsons turbines. Of the two turbine boats, the "Manxman" was provided with turbines of 25 per cent more power than those on the "Londonderry." By the terms of the contract the vessels were to maintain 20 knots per hour with two double-ended boilers under steam, and on the trial the "Antrim" under these conditions showed 20.6 knots, the "Londonderry" 21.6 knots, and the "Manxman" 22.65 knots per hour. With all the boilers in use, the respective speeds were 21.86, 22.36, and 23.12 knots per hour. During the trials the decrease in water consumption in the case of the "Londonderry" amounted to 8 per cent, and of the "Manxman" to 14 per cent, as compared with the two reciprocating-engine boats. It follows that there was a corresponding decrease in coal consumption by the turbine boats, the "Manxman" making 20.3 knots on the same amount of fuel that was burned by the "Antrim" when making 19.5 knots. There was a great economy in the amount of lubricating oil consumed, which in each turbine steamer amounted to 5 gallons per single trip. This again resulted in further economy, by the reduction of the staff in the engine room from four greasers to two. To these advantages must be added the almost complete absence of vibration. Furthermore, in the whole period of service the turbines have cost practically nothing for upkeep. There is a saving in the weight of the hull in the turbine steamers of about 30 tons, and in the weight of the engines, shafting, and propellers, of 85 tons. These two items together represent a saving of 115 tons, or 6 per cent of the weight of the steamer when running light.

PANAMA CANAL IN FOUR YEARS.

Among the many engineers who have made a careful study of the Panama Canal problem, there is none that has so intimate a knowledge of its purely engineering features as M. Bunau-Varilla, who was for several years chief engineer of the late French Panama Canal Company. It is a fact that most of the later survey work and tentative plans of the Panama Canal that have been executed since the United States became interested as a probable purchaser of the property are based upon and include the very exhaustive engineering data that were obtained by the engineers of the old Panama company. That the former chief engineer maintains his qualification to speak with authority on this great question is shown by the invariable good judgment and sound engineering sense that have marked all of his published articles or spoken suggestions on the Panama Canal question.

The latest plan suggested by Bunau-Varilla, and recently laid before the President and before the International Board of Engineers, has so many features to recommend it, and is such a happy compromise of widely diverging schemes for canal construction, that we look to see it adopted unless some serious engineering difficulties, not anticipated by the former chief engineer, should present themselves. As matters stand, opinion is divided as to whether a sea-level canal should be built or one with locks; that is to say, whether the canal should have a summit level at 30, 60, or 90 feet, or be boldly cut through at tide level from ocean to ocean. The 90-foot level scheme is that of the original French company, and it has received the indorsement of an international board of engineers of high standing. The sea-level scheme, due originally to De Lesseps, was first seriously revived by the late Chief Engineer Wallace, who now appears to have based his calculations upon data which gave too optimistic an estimate. There can be but little doubt that Mr. Wallace's statements as to the low cost and short time in which the sea-level canal can be cut through must be taken with very grave reserve. At the same time there can be no doubt that the idea of the United States opening the canal at sea level has taken a strong hold upon the imagination, if not upon the judgment, of a large number of members of Congress, and of the people of the United States as a whole. If there should eventually be a consensus of expert opinion among the engineers that a sea-level canal can be built within a reasonable time and at a not too heavy cost, it will be found that the nation stands ready to indorse it.

Judging from the start that we have made in this great matter, it seems to be very certain that the immediate digging of a sea-level canal will require a length of time and an expenditure of money that will be prohibitive. On the other hand, if the original Panama Canal company's plan for a 90-foot level, but with an enlarged prism and longer and deeper locks, be adopted, it becomes a question, in view of the rapid increase in the size of ships and the bewildering growth and magnitude of the world's shipping, whether the construction of a canal with locks upon dimensions and by methods that prohibited any future enlargement or change would not be a short-sighted policy that might eventually lay a heavy restraining hand upon the future development of traffic by this great waterway.

As a compromise between these two plans the suggestion offered by M. Bunau-Varilla is very timely, and should it be approved by the International Board of Engineers, it would prove to be an admirable solution of the difficulty. He proposes to build a canal on the location which would be chosen if it were to be cut through at sea level, but to plan the various levels and locate the different locks with a strict view to securing the earliest possible opening of the canal; an event which, he believes, could be accomplished, if his suggestions are followed, within four years' time. The broad principle upon which he would proceed would be that of so accommodating the plans of the canal to the topographical features of the Isthmus that its opening could take place within the least possible time. Commencing with the Culebra cut, which is the determining factor, he points out that already the mountain has been cut down from 300 feet above sea level to 150 feet. He would place the summit level of the canal at 130 feet, cutting it to provide a uniform depth of 35 feet throughout. Descent to tide level would be made by eight locks, four on the Pacific and four on the Atlantic side; and it is because of the comparatively small amount of excavation that would have to be done, that he estimates that a canal built on these lines could be opened for navigation within four years.

Although the 130-foot level canal would have a capacity far larger than the traffic that would immediately seek the new waterway, it would be considered as temporary and as serving its purpose merely while the work of cutting down the various lock-levels to tide level was being carried on. The proposed plans provide for carrying on this further work of excavation without in the least interfering with the existing traffic. This is rendered possible by carrying the masonry of the locks down to tide level, an arrangement which would permit of the upper portions of the locks being removed to keep pace with the gradual lowering of the summit level. It is estimated that the work of transforming a lock canal with 130-foot summit level into a sea-level canal would occupy a period of from five to seven years, the time varying according to the bottom width determined upon for the canal. If the bottom width were 150 feet, five years would suffice, and seven years if the bottom width adopted were 300 feet. Finally, according to this French engineer's estimate, the change from a lock to a sea-level canal can be made without incurring a greater cost of excavation per unit than would result in the immediate excavation of the sea-level canal as at present proposed.

RECENT ADVANCES IN SELECTIVE WIRELESS TELEGRAPHY.

Early in the experimental struggles of wireless telegraphy it was found that the parabolic reflector as a means for directing messages would have to be abandoned, since the power of the waves was so greatly cut down as to render it useless for commercial purposes, yet it was evident that without selectivity the field of the new art would be greatly circumscribed. Consequently, since those historic days many schemes have been proposed for accomplishing the desired result, ranging from the transmission of waves unidirectionally as cited, to the propagation of waves of predetermined length and which would act only on a receptor tuned to receive them.

One of the earliest devices for carrying out the first method was designed by M. Emile Guarini Foresio and consisted of inclosing the sending and receiving aerial wires in slotted sheaths with their openings facing each other, when the waves emitted by the one would be projected only in the direction of the other or complementary wire, while the sheath inclosing the latter would reflect such waves coming from all other directions, preventing them from impinging on the aerial proper, or if oscillations were set up in the sheath, the energy would be conducted to the earth and there dissipated. While experimentally possible, this method did not fulfill the exacting conditions required in practice with any marked degree of success, for, as in the earlier Marconi apparatus, there was an exceeding loss of energy and its usefulness was greatly limited by the restricted radius of the field it would cover.

A marked advance in sending wireless messages in a given direction has been brought out in Italy by Alessandro Artour, Esq., C.E., who has succeeded in producing circular and elliptical rays of electric waves which are sent forth in any desired direction with great power. Herr Zehnder was the first actually to produce circularly and elliptically polarized electric radiations experimentally, in 1894. His plan was to utilize a pair of plane polarizing grids made of a number of parallel wires attached to a frame and place them parallel to each other a short distance apart and with their wires crossed. These two grids will reflect electric waves in the same manner that wire gauze will reflect light, and if the crossed wires of the grids are separated a distance of one-eighth of a wave-length and the plane of the incident radiation is 45 degrees to the plane of the wires the reflected radiation will be circularly polarized, but if the relations of the planes are changed the polarization will be elliptical.

For the purposes of commercial wireless telegraphy this method is obviously impracticable, since the absorption losses would be prohibitively large. Signor Artour seems to have greatly reduced the dampening factor by devising a suitable apparatus for producing circularly and elliptically polarized electric radiation by a direct method, viz., connecting the secondary terminals of an ordinary induction coil with the balls of the usual spark-gap, while a third spark-ball is connected through a condenser with one side of the secondary circuit, the three balls being disposed as the vertices of an isosceles triangle. To set up and propagate circularly and elliptically polarized waves, the aerial wires are in the form of the letter X, with the positive and negative balls of the spark-gap connected thereto at the lower terminals respectively, while the third spark-ball leads to the earth. In this ingenious fashion circularly and elliptically polarized electric waves are directly produced without reflection; the

ray formed may be transmitted in any direction, while its effective range has been demonstrated up to a distance of 300 kilometers.

The second method referred to holds out greater possibilities, although it has proven infinitely harder of solution; this is syntonization based on electrical resonance. Sir Oliver Lodge was the first to evolve a system of syntonic wireless telegraphy in which the coefficients of inductance, capacity, and resistance were considered. Since these early essays Lodge has, in conjunction with Dr. Alexander Muirhead, devised and invented many ingenious improvements relating to the practice of syntonic wireless telegraphy. In this connection it must be borne in mind that there is a well-defined demarkation between what is called *syntonic* and *selective* systems, although at first the object of the former was to produce the latter. Not very long ago these words were used synonymously, but as the art unfolded it was found that while a transmitter and its complementary receptor could be attuned to the same wave length and were made the better for it in every way, they were not by any means rendered selective.

The latest researches of the eminent physicist and electrician named that have been made public relate to syntonizing a transmitter and a receptor in which a greater certainty of action is obtained. The invention is the outcome of an experiment wherein a long wire attached to a discharging Leyden-jar circuit was thrown into violent electric oscillation in synchronism with the jar and this is combined with an "overflow," the result of another experiment, in which a long wire appendage was employed to set up oscillations in a Leyden-jar circuit and cause it to be charged to a point where it would overflow and disrupt a minute spark-gap; these two effects were again combined with a third, also discovered by Lodge, and produced by the "syntonic" Leyden jars; in this arrangement the oscillations of one discharging Leyden-jar or condenser circuit set up similar, though more feeble, oscillations of the same phase and frequency, in a distant Leyden-jar or condenser circuit tuned with a precision to the first.

The combination of these three very pretty laboratory experiments into a hard-and-fast commercial system has brought out several novel features, the chief one being the surging of violent electric oscillations in the condenser charged by the secondary of the induction coil and the impulses of which are conveyed to the upper end of the aerial wire resulting in a series of sharp recoil kicks. This sudden rebound exerts a much greater effect in the surrounding ether than a simple periodic oscillation would. On reaching the distant station these wires set up oscillations in the receiving wire to which is attached a condenser circuit similarly attuned to that of the emitting station; in the condenser or internal circuit the oscillations work up gradually in strength until they become strong enough to break down the resistance of the coherer. This is brought about as soon as the maximum potential attained by these oscillations in the condenser circuit is high enough to cause an electrostatic overflow which takes place through the coherer; this causes a reduction in the resistance of the latter and the consequent formation of a signal by the receiving device.

The novelty in this part of the invention is found in the mode in which the coherer is connected with the receiving condenser so that it will be impressed with the overflow or cumulative action of the waves, and such is the disposition of the circuits that it is, at the same time, protected from the direct action of the elevated conductor or any sudden impulse to which the latter is exposed.

While these inventions do not by any means solve the vexatious problems of selective wireless signaling, they are vitally important in that they show that more and more effective means are being constantly devised by which the requisite energy is reduced and the accuracy of the working is increased, while at the same time the accumulated knowledge must lead eventually to a system of selectivity and all that this much-abused term implies.

THE HEAVENS IN OCTOBER.

BY HENRY NORRIS RUSSELL, PH.D.

The best "landmarks of the sky" for a beginner in the study of the constellations are the groups of stars which lie near the pole, for these, in our latitude, are visible at all hours of the night and in all seasons of the year. How this happens can be very clearly illustrated by a simple photographic observation, which can be made with any camera.

Choose a clear moonless night, point the camera toward the pole star, and expose for a couple of hours (using the largest stop). When the plate is developed the stars will appear, not as points, but as long trails, owing to their apparent motion, and these trails will all be arcs of circles, with a common center. This shows that the apparent motion of the heavens, which causes the sun, moon, and stars to rise and set, is really a rotation about a fixed point, which astronomers call the celestial pole. Each star describes a circle about this pole every day. If the star is near the pole, the whole of this circle is above our horizon, and the star never sets. For stars farther from the pole, a larger and larger part of the circle lies below the horizon. Stars in the southern sky describe circles about the south celestial pole, which is as far below our horizon as the north pole is above it, so that some southern stars are only visible to us for a small part of their circuit, and others still farther south never rise above our horizon at all.

If we make a print from our negative, and mark the beginning or end of each trail with a conspicuous dot (to avoid confusion due to overlapping trails), we can easily identify the stars visible on our photograph, and in particular the pole star. It will be seen that the latter is not exactly at the celestial pole, but is some little way off in the direction of Cassiopeia. We see also that our photograph shows much fainter stars close to the pole than some distance away. This is because the close circumpolar stars have shorter trails, so that their light is less spread out on the plate, and a fainter star can thus produce a visible impression.

Of the circumpolar constellations, the most familiar is the Great Bear. At the present season this is not very conspicuous, as it lies below the pole, with the Dipper close to the northern horizon, and the Pointers almost under the pole star.

A line drawn from the middle of the Dipper handle through the pole leads us to Cassiopeia, whose principal stars form a zigzag line in the Milky Way, resembling an irregular letter W. A line drawn to the left through the pole star at right angles to this last line, points out the head of Draco, formed by a quadrilateral of stars, of which the faintest is double, much too close for the naked eye, but separable with a strong field glass. The constellation extends in a long line of stars, first upward to the right, then down to the left, then again to the right, above the Dipper. Within its curve it incloses the smaller constellation of Ursa Minor, which contains one other star about equal in brightness to Polaris.

The remaining circumpolar constellations are inconspicuous, Cepheus, which lies between Draco and Cassiopeia, being the most prominent.

To the east of Cassiopeia and below it is Perseus, whose principal features are a curved line of stars in the Milky Way, and a single bright star south of them, which is the remarkable variable Algol. Between Perseus and Cassiopeia is a bright spot in the Milky Way, which the telescope shows to be a very fine star cluster.

Below Perseus on the left is Auriga, recognized by the very bright star Capella and the irregular pentagon which it forms with the neighboring stars. On the right is Taurus with the unmistakable group of the Pleiades, and the bright red star Aldebaran. The very bright object between them is the planet Jupiter. The great square of Pegasus is southeast of the zenith, and Andromeda lies between it and Perseus. Cygnus and Aquila lie in the Milky Way to the westward, and Lyra farther northwest, with Hercules below it.

Below the groups already named are the dullest of the zodiacal constellations. Sagittarius is just setting. Capricornus follows it, marked only by a pair of small stars—both double—southeast of Altair. Aquarius comes next, and can be identified by a little group, shaped like the letter Y, lying on its side, which lies southwest of the great square of Pegasus. Pisces has no conspicuous stars, but Aries contains a small but rather conspicuous triangle, with very unequal angles, which lies below Andromeda and to the right of Perseus.

The large constellation Cetus fills the southern sky, but contains nothing to delay us at present. The isolated bright star low down in the south is Fomalhaut, in the Southern Fish. Saturn, which is a good deal brighter, is higher up and farther west.

THE PLANETS.

Mercury is morning star till the 12th, when he passes through superior conjunction and becomes an evening star. Throughout the month he is too near the sun to be seen with the naked eye.

Venus is morning star in Leo and Virgo, rising at about 4 A. M. in the middle of the month.

Mars is evening star in Sagittarius, setting between 9 and 10 P. M. all the month. On the 8th he is in conjunction with Uranus, which is about 1¾ degrees south of him.

Jupiter is in Taurus, rising about 8 P. M. on the 15th, and is rapidly becoming the most conspicuous object in the evening sky.

Saturn is in Aquarius, and crosses the meridian about 9 P. M. on the 1st, and 7:15 P. M. on the 31st. He is therefore very conveniently observable in the evening. A very small telescope will show his rings, and one a little larger will show his brightest satellite, Titan. This is west of the planet on the 4th, north on the 8th, and so on, its period being 16 days.

Uranus is in Sagittarius, and can best be identified by its proximity to Mars on the 8th. Neptune is in Gemini, and comes to the meridian about 5 A. M. in the middle of the month.

THE MOON.

First quarter occurs at 8 A. M. on the 5th, full moon at 6 A. M. on the 13th, last quarter at 8 A. M. on the 21st, and new moon at 2 A. M. on the 28th. The moon is nearest us on the 27th, and farthest away on the 14th. She is in conjunction with Mars on the 4th, Saturn on the 8th, Jupiter on the 17th, Venus on the 26th, and Mercury on the 28th.

Princeton University.

SCIENCE NOTES.

Some interesting photos and particulars of huge gorillas hitherto unknown have been obtained by M. Eugene Brusseaux, a French official and explorer from Northern Africa. One of these huge monsters was shot by one of the official's sharpshooters. The animal measured 7 feet 6 inches in height, was 4 feet in width across the shoulders, and weighed 720 pounds. One of the hands when dismembered weighed 6 pounds. It required the united efforts of eight native soldiers to drag the corpse of the beast from the point where it was killed to the French residency at Quessou, the administrative center of Central Sangha. The animal was here skinned and buried. Reports have been received at this station frequently during the past few months of the presence of these huge monsters in the upper valleys of Lonani and Sangereh, but hitherto it had been impossible to come to close quarters with them. According to native reports, however, the animals are unusually ferocious, not hesitating to attack caravans during their passage through the country. The beasts differ essentially from the gorillas familiarly known. The ears are small, the shoulders and thighs are covered with dense and long black hair, while the chest and stomach are almost bare. It is believed that they belong to a species that has not heretofore been known.

The action of ultra-violet rays upon glass has been observed by Franz Fischer, a German scientist. In order to make the researches, he uses a mercury arc contained in a quartz tube as a source of the rays. Samples of different kinds of glass are placed quite near the tube, separated from it by a very thin layer of air, or the air can be replaced by hydrogen. By using a water-cooling device the apparatus is not allowed to become unduly heated. This precaution is not always needed, however. He uses a low tension of 18 volts on the arc. Under these conditions he exposes eight samples of glass to the light of the arc. Four of them are not acted upon, and remain colorless. The other four take a strong violet color at the end of 12 hours. The color can be seen at the end of 15 minutes exposure. Upon analyzing the samples of glass it is found that the ones which are colored all contain manganese, while in the other specimens it is absent, or nearly so. These results seem to explain the phenomenon which was observed by Crookes, who observed that pieces of glass exposed to the sun at an altitude of 12,000 feet at Myni, Bolivia, took a violet color by degrees. At this altitude the sun's light contains a large proportion of ultra-violet rays which act upon the manganese salts of the glass and cause the violet coloration. It is found that the color quickly disappears when the glass is heated to the softening point. Then when it is cooled and again exposed to the mercury arc, it takes the violet color, as before. That it is only the rays of short wave-lengths which produce the color is proved by placing a sheet of mica over the glass, and in this case no color is formed. The mica itself is not colored in this case.

Researches on Radium and Radio-activity.—In a paper read before the Société des Ingénieurs Civils M. Besson explains the method by which M. and Mme. Curie were led to discover new radio-active bodies in the ores of uranium, and reviews the preparation of radium, the composition of the Becquerel rays emitted by radium, and the demonstration of MM. Curie and Dewar that radium is converted into helium; and finds in this decomposition the source of the energy of radium. He holds that the decomposition for bodies of light atomic weight would be general; uranium would be converted into radium, then into helium; thorium would be converted into argon. He states that the ores recently discovered in the Department of Saône-et-Loire are pyromorphites, probably rendered radio-active by emanations proceeding from dissolution in water of the phosphites of uranium found in the same lands. The simplest process for search is that of photographic plates. It is sufficient to pulverize the ore believed to be radio-active, to put it in a cup and leave it for twenty-four hours, well surrounded with black paper. By comparing the marks produced by a small parcel of the uranium metal with those produced by the ore supposed to be radio-active, it is easy to ascertain whether this contains radium or not.

SOMETHING ABOUT ALLIGATORS.

The odd photograph reproduced in the accompanying engraving shows four rather unhappy-looking baby alligators. Probably as long as this species of saurian has been known, the young have been kept as curiosities, and most amusing pets do the little fellows make. Unlike the young of other wild animals, which are sometimes domesticated when small, they grow very slowly, especially when out of their natural environment, and are consequently well adapted for this purpose, as a number of years elapses before the alligator is large enough to be troublesome or even dangerous. Alligators do not appear to be very intelligent, the recognition of the person who feeds them in captivity being about the limit of their mental attainments. The older ones are sluggish and lazy, though they sometimes fight viciously with each other, and are capable of doing terrible execution when aroused.

If properly taken care of, the young alligator will thrive even in unnatural circumstances. His main requirement is sufficient heat, and if his box or cage be kept at too low a temperature, the little reptile becomes languid and almost torpid, refuses to eat for long periods, and frequently dies at the end of some weeks. If, however, the temperature of the air be raised, or the tank wherein he lies be warmed by the addition of a little hot water, he soon revives, and attests his continued interest in life by renewed activity and the reappearance of his appetite. Unlike the older members of his family, the young 'gator in captivity is quite lively; sometimes of an investigating turn of mind, and usually combative, his antics are often diverting. If he can escape from his cage, he will travel considerable distances, and unless overcome by cold will wander indefinitely, subsisting as best he can.

Many people who have attempted to keep young alligators have made the mistake of trying to feed them on a vegetable diet, for the alligator is first and last a carnivore. The diet of the young, who should be fed nearly every day, is very simple, and consists of bits of fresh meat, insects, and worms. They often show great fondness for the ordinary earthworm, and will frequently refuse all food but these. The larger specimens in captivity are fed about three times a week on fresh meat or small live animals, and they require little attention other than this. The older ones, particularly the males, will, if possible, eat the small alligators with avidity, and to check these cannibalistic tendencies, the reptiles must be properly segregated.

Alligators seldom breed in captivity, and while the females sometimes lay eggs, the latter are usually unfertile. However, eggs that have been found in a natural condition in the curious cone-shaped mud nests are easily hatched by the application of heat, and while the young are at first feeble and helpless, they usually survive if carefully handled. Alligators live to be of great age, and there is a number of authentic records where individuals have been known to exist for nearly a century.

A NOVEL PROCESS OF REANIMATION.

BY DR. ALFRED GRADENWITZ.

Any methods so far suggested for restoring asphyxiated persons to life by artificial respiration, valuable though they prove in many cases, are still rather imperfect. Far better results would be obtained by acting simultaneously and intensely both on respiration and on the circulation of the blood.

Considering the well-known process of artificial breathing in the case of a horizontal supine position of the patient, it will be seen that with each inspiration, following a compression of the thorax, the latter owing to its elasticity will rise distinctly, drawing in air into the lungs, but that at the same time the abdomen is lowered in a most striking manner. The latter phenomenon is due to the external atmospheric pressure acting on the bowels through the soft and yielding wall of the abdomen, thus considerably obstructing the flattening of the diaphragm. The internal compartment of the breast will accordingly be increased only to a small degree, thus greatly reducing the effects of artificial breathing, and the same is true of expiration. As regards the other factor of importance in connection with reanimation, viz., the circulation of the blood, artificial respiration will no doubt exert some unfavorable influence on that factor also, the motion of the blood being interfered with to a degree the greater as the inspiratory pull is more intense and the pressure of expiration in the thorax stronger. This twofold undesirable effect will doubtless greatly diminish any chance of success in the event of the heart having stopped.

Now, Dr. R. Eisenmenger, of Szászváros, Hungary, has had the idea of trying artificial breathing by simply acting on the abdomen without producing any motion of the thorax. By means of an apparatus constructed by him he is able to diminish or to increase the atmospheric pressure acting on the abdomen to any desired extent.

A HANDFUL OF ALLIGATORS.

The apparatus consists of a lateral vaulted shield fitted with flexible extensions which can be fitted air-tight on its edge, while the convex part carries an aperture, to which a tube can be fitted. Now this shield is placed above the abdomen and the lower part of the thorax, so as to cover as with a bridge the whole of the former, while the tightened edge is made to rest on resisting parts of the body. In the space left between the body and the shield and which is inclosed air-tight, the air is alternately drawn out and forced in by means of suitable bellows.

The accompanying diagram illustrates how respiration is produced by means of this device. Supposing *I* to represent the thorax, and *I I* the abdomen, *c d* will be the diaphragm and *c b* the wall of the abdomen. If the atmospheric pressure acting on *c b* be decreased by means of the bellows, this action will be transmitted through the yielding walls of *I I* and *I*, drawing atmospheric air through the air channels, *e a*. The volume *I* will thus be increased and the diaphragm will be displaced toward *c g d*, while the wall of the abdomen is shifted to *c f b*. Inspiration by this artificial process will accordingly be quite analogous to what takes place in the case of natural respiration. If now the atmospheric pressure above *c f b* be increased, the latter will take the position *c h b*, while *c g d* is shifted to *c i d*, resulting in the air from the lungs escaping through *e a*. The inert diaphragm will thus perform passively the same motions (but for the excursions being greater) as under normal conditions of life, by virtue of the rhythmical increase and decrease of the atmospheric pressure acting on its concave surface.

The pressure in the thorax and abdomen is considerably reduced during inspiration, and as the blood vessels in this compartment are subjected to lesser pressure than those lying outside of them, the blood will be made to flow from the periphery toward the place of smaller resistance, thus fully supplying with blood any organs of the thorax and belly, including the right half of the heart and lungs. During expiration the blood will be thrown out again from the breast and abdomen, owing to the increase in pressure on *c b*, and on account of the valves inserted in the circulation (in the heart and veins) it will be allowed to flow only in one direction.

The fact that in this novel process the lungs are filled with blood at the same time inspiration occurs is of the highest importance, as it greatly facilitates the exchange of gases. Successful results can thus be obtained even in cases where both spontaneous respiration and action of the heart have ceased. In fact, the heart will be enlivened on one hand by the blood traversing it and on the other by the oscillations in pressure, which act in a way analogous to what has been called heart massage.

It has been shown of late years that both animal and human hearts, after being separated from the body, can be restored to activity even two days after death has occurred by throwing salt solutions or other convenient liquids rhythmically through them, and that they will go on beating for hours, until their energy is all exhausted, when the definite standstill ensues. The diagram illustrates the action on the heart occurring in Dr. Eisenmenger's process.

The movable wall of the abdomen, *c b*, which is alternately pressed down and drawn upward by the process above described, will transmit this reciprocating motion through the bowels of the abdomen to the diaphragm, which is made to perform analogous movements, resulting in an inspiration and expiration through the air channels, *e a*. The heart, which is located in the compartment *I*, is thus alternately compressed strongly by the diaphragm, *c i d*, as it is thrown upward, and expanded violently as this muscle is thrown downward to *c g d*. The artificial negative pressure in *I* and *I I* will obviously result in hyperæmia (excess of blood) in the vessels both of the breast and abdomen, when the blood will flow toward the right half of the heart from the upper vein of the throat, as may be distinctly observed by the pulsation of the latter. By virtue of the lively aspiration, the blood will even traverse the right heart in the direction of the open valves and get into the pulmonary arteries.

If at the beginning of the other phase of the process the pressure within the abdomen is increased, part of the abdominal blood will first be conveyed toward the heart, while another part retrocedes into the lower extremities to the extent allowed by the valves of the veins. As the pressure increases in the abdomen the diaphragm is thrown upward through the intermediary of the bowels, thus compressing the veins of the thorax and the heart and lungs which had been filled by previous actions.

It will be readily understood that these oscillations in pressure as produced artificially by a rhythmical increase and decrease in the atmospheric pressure acting on the abdomen will exert a kind of massage on the heart, a distinctive feature from the usual action being that not only the increase in pressure but the adjustable decrease in pressure are allowed to exert their effect. If ordinary massage be called positive, the Eisenmenger process can be appropriately called an alternately positive and nega-

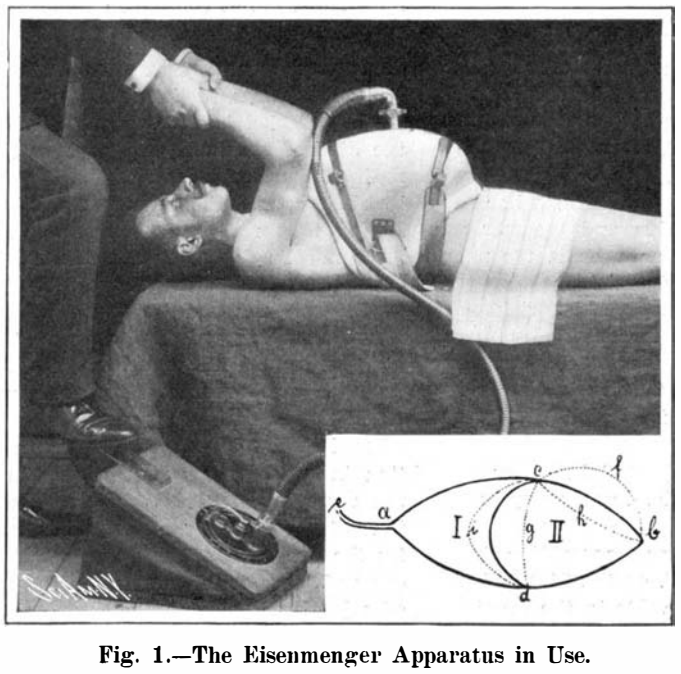


Fig. 1.—The Eisenmenger Apparatus in Use.

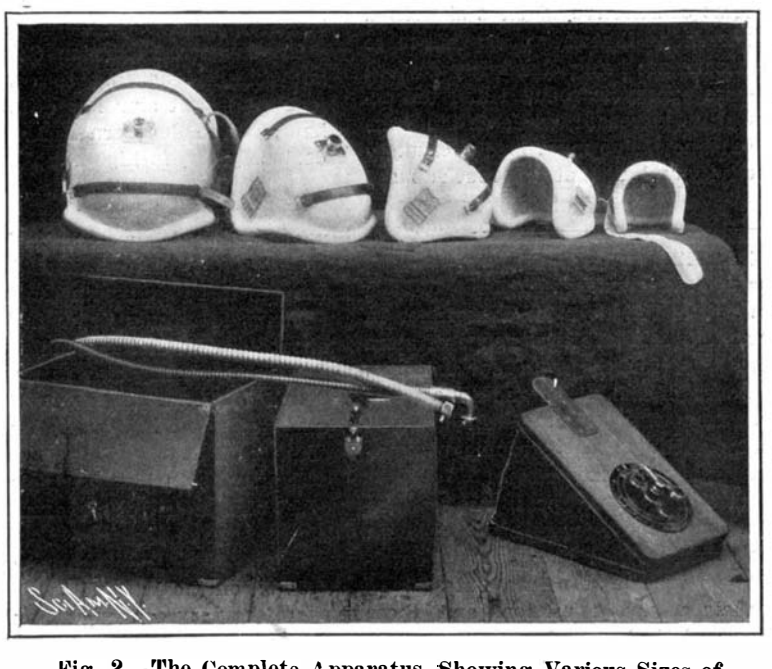
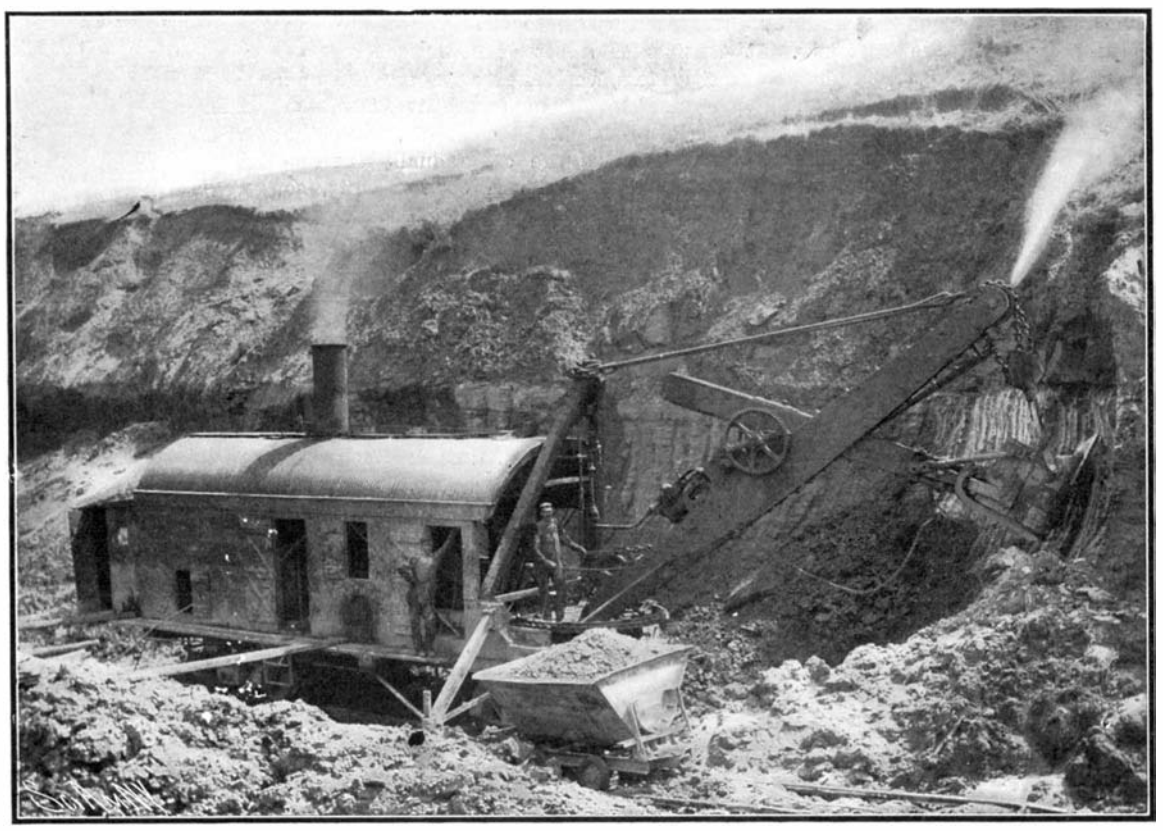


Fig. 2.—The Complete Apparatus, Showing Various Sizes of Abdominal Shields.

A NOVEL PROCESS OF REANIMATION.

tive massage. Now the latter will obviously have a most powerful influence on the motion of the heart and blood. Another advantage of the process over direct massage is the fact that at the same time the heart is acted on, the lungs are fully ventilated, artificial respiration being produced simultaneously. This process of heart massage in connection with simultaneous artificial respiration will warrant success even in most hopeless cases, another good point being the fact that it can be continued for a long time without fatigue.

Experiments made on fresh corpses (that is to say, in the case of absolute standstill of the heart) have shown the blood to be sucked into the right heart and into the lungs and afterward to be thrown through the vessels of the lungs into the left heart, whence it must be thrown into the arteries, owing to the increasing pressure. These experiments have really borne out the fact that the above process not only warrants an artificial respiration more analogous to the natural process than any other method, but at the same time an artificial circulation of the blood. Owing to the revivifying effect it exerts on the organism the apparatus will be used to advantage also in the case of many affections of the body. It has been given a most convenient form and is constructed by Hermann Straube, of Dresden-Neustadt.



Digging Out Shale With the Steam Shovel.

BRICK MAKING.

BY W. FRANK M'CLURE.

Brick making, like so many other industries of ancient origin, has undergone a very marked evolution in recent years. Machinery has taken the place of dynamite in the loosening of shale, one machine accomplishing the work of seventy-five men. After coming from the pug mill, the pasty material is cut into the shape of bricks by machinery which works automatically. Modern methods also provide for the using of exhaust steam and heat from the kilns for the heating of the drying house.

The demand for brick of nearly all kinds is increasing. The value of common brick alone according to recent statistics is more than forty per cent that of the entire clay products of the United States. The accompanying photographs were made in Cuyahoga County, Ohio—the State which leads all States in the production of clay products. And while in the amount of common brick the Buckeye State is exceeded by three other States, in the production of paving brick Ohio leads. Cuyahoga County yields vast quantities of the shale and clay used in the making of paving brick. It is said that the various brick-making industries of this section have a combined daily capacity of more than 500,000 bricks, besides many new kilns building.

At the site where the steam shovel in the photograph is at work, it is estimated that there are more than 25 acres of shale and clay. Beneath a depth of about 30 feet of clay there lies between 300 and 400 feet of shale, and beneath this lime rock. As yet the digging is done only in the side of the banks, and not below the surface. In fact, it will be many years before it will be necessary to dig below the level. The machine used for extricating the clay and shale is a steam shovel, which has a daily capacity of 500 yards of shale or 1,500 yards of clay. It is operated by two men. The scoop of this machine is also used in loading the raw products onto cars, which in turn deliver it to the brickyards.

From the cars the clay and shale are shoveled into grinders, which reduce these two products to a powder, which in turn is carried by a bucket elevator to a big hopper. After it has been sufficiently screened, the powdered clay and shale next go to the pug mill, that which will not pass the screen going back to the grinders again. In the pug mill—a sort of conical trough—the raw material is tempered with water, and kneaded by means of a device somewhat resembling a screw propeller in shape. From this mill it is forced through a mold into one long, continuous brick, and this, as it comes from the mill, is carried on a wide belt to a cutting machine, which automatically cuts the continuous brick into many bricks of just the desired size, the machine cutting sixteen bricks at one time. As the bricks come from the cutting machine, still soft and still resting on the belt, they are loaded onto flat cars and removed to the drying house, where they remain not less than a day and night. The capacity of a large drying house is about 100,000 bricks. The different apartments of this house are brick-lined.

The brick next go to the kilns for baking. One of the engravings gives a good idea of the manner in which these brick are piled within the kilns. Five or six men often work three full days in filling one kiln, which fact gives some idea of the size of the interior. After the entrance to the kiln has been closed and sealed, the fire beneath is started. The baking process is then continued for nine or ten days, the temperature maintained within being 2,300 deg. F. Then, when the kiln has been cooled, the bricks are taken out and are ready for shipment. Where fifteen or sixteen kilns are in use, the daily capacity of ordinary-sized brick may reach 150,000.

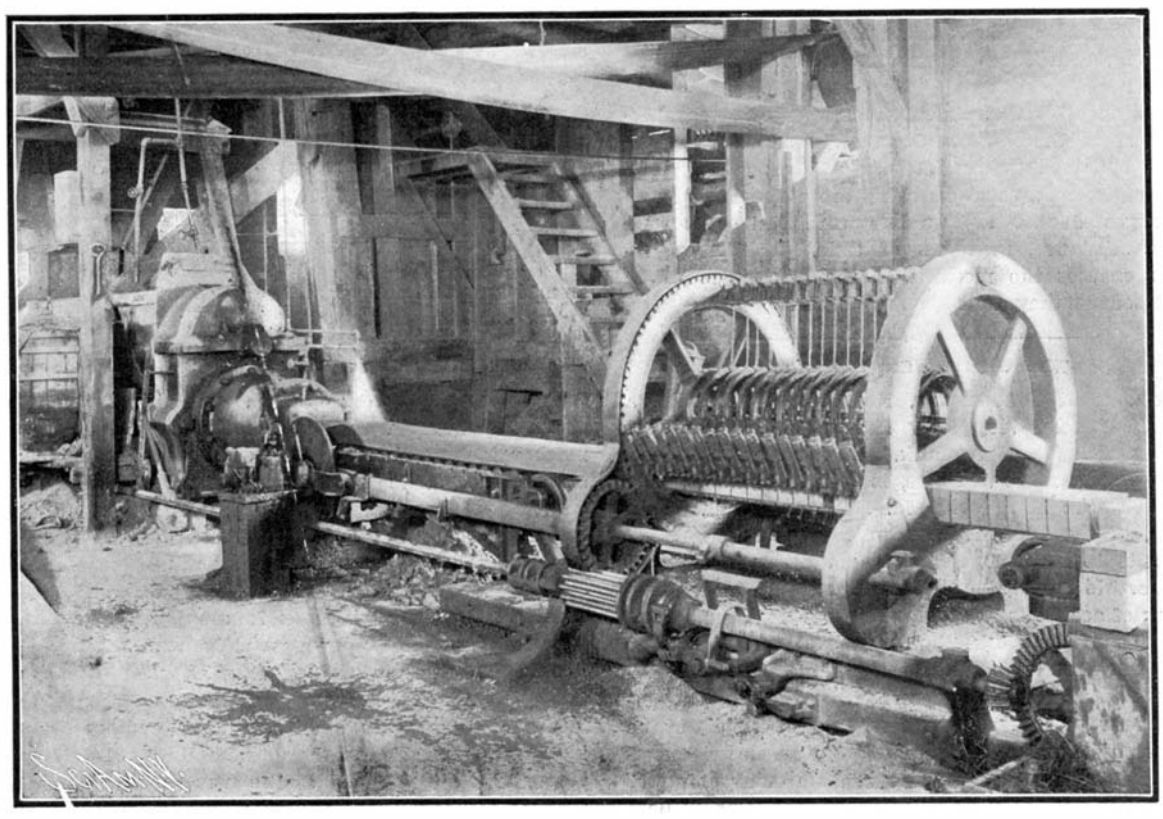
Some skill is required in operating the kilns while the baking is in progress. Cognizance must be taken of the heat-giving power of the fuel, the burning qualities of the brick, and the draft of the kiln. A uniform heat must be maintained. When the baking process has been finished dampers are opened, and the heat from the red-hot brick is forced by means of a fan to the drying house through brick-lined flues. This heat, together with the exhaust steam from the engine, comprises the economical method for heating the drying house heretofore mentioned in this article.

Besides common brick, front brick, and vitrified paving brick, there are the fancy and ornamental brick, enameled brick, fire brick, ornamental terra cotta, fireproof partitions, sewer pipe, drain tile, and some others, the manufacture of which requires slightly different methods of production, but all coming under the head of clay products.

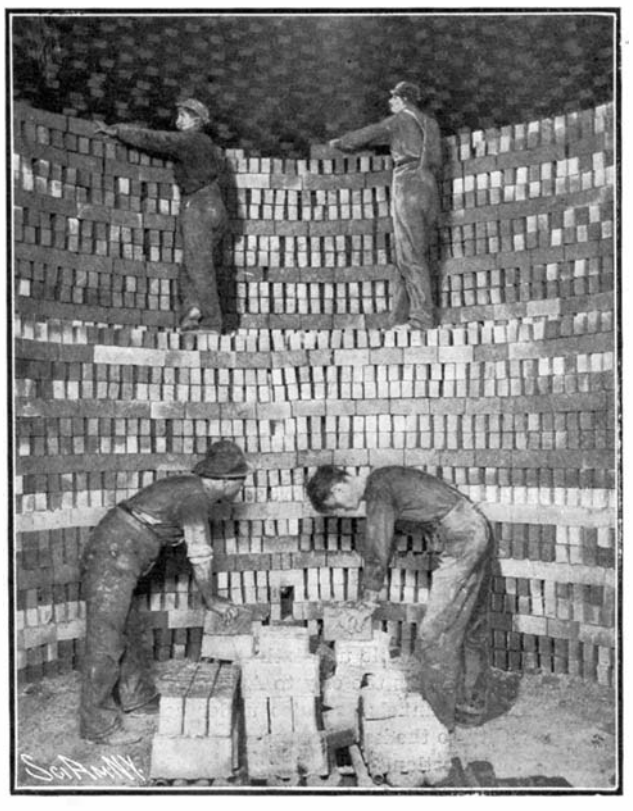
Waldstein and Herculaneum.

Prof. Charles Waldstein, of Cambridge University, announces that influential personages have promised their support of his scheme to excavate Herculaneum, and that the plan will yet be carried out.

Dr. Waldstein declined to be more explicit, but he was evidently sanguine. It seems that the "influential personages" to whom he referred must be members of the Italian government. So far as enthusiastic approval and support in other countries went, he had all that he required before. It was only the attitude of the Italian authorities which prevented the success of the scheme and the commencement of work at Herculaneum a year ago.



Pug-Mill. Brick-Cutting Machine in the Foreground.



Interior of a Modern Brick-Kiln.

IMPROVED METHODS OF MAKING BRICK.

Engineering Notes.

An ingenious railroad ticket printer has been devised by Count Piscicelli, an engineer of Naples. With this appliance, which is of simple action, the railroad tickets are printed and issued as required, thereby dispensing with the necessity of maintaining large supplies for issue at various stations, while on the other hand fraud, either by railroad officials or the public, is rendered absolutely impossible. The printer is started by a lever working perpendicularly in a slot. On each side of the slot are the names of the different stations of the system, and the lever is depressed to the name of the station required. This action causes a disk to appear on the outward part of the machine, showing the destination of the traveler, together with the price of the ticket. By use of a small bolt the machine can be made to print first, second, and third class tickets, single or return, as well as privilege tickets, etc., on different colored cardboards. Each ticket is reproduced upon a ribbon for the clerk to preserve and the amount encashed appears on small disks on his left hand. Another set of disks on his right hand shows the total amount of money taken. The invention is at present being tested by the Italian railroads.

Suppression of Sounds and Trepidations.—At a recent session of the Societé des Ingenieurs Civils, M. Prache presented a communication on the suppression of vibrations by means of the Anthoni-Prache system. He classifies vibrations as sounds and trepidations. The distinction between different sounds can be distinguished by the ear. Researches as to their origin can alone give information as to their mode of transmission, which it may be important to know. The interposition of obstacles attenuates the sounds transmitted by the air. Insulated foundations suppress the transmission by the ground of sounds and trepidations. Of all insulating substances, caoutchouc, or rubber, alone possesses the requisite qualities, homogeneity, firmness, and elasticity, which is about twenty times as great as that of steel. He shows: (1) that the constancy of the volume appears to be the characteristic of deformations purely elastic; (2) that the module of elasticity may be defined as the ratio of the variation of force to the variation of section perpendicular to the force; (3) that for great deformations, if one is sheltered from secondary phenomena due to the influence of the weather, permanent deformations, etc., and if the forces per unit of section and the sections are taken as co-ordinates, the curve obtained is an hyperbole. The velocity of propagation through caoutchouc may be reduced to a few meters per second. From the great difference between the velocity of propagation through caoutchouc, and through other solids, it results, according to the theory of Fresnel, that the intensity of the refraction is essentially null, and that there is a total reflection when the vibration tends to pass from the caoutchouc into the ground.

Opening of Second Hudson River Tunnel.

Connection by tunnels between New York and New Jersey was completed on September 29, 1905. With the breaking through of the last barrier on the Manhattan side of the North River there was brought to a successful close, after difficulties seemingly insuperable, the greatest engineering feat of its kind.

The length of the tunnels between the shafts at Jersey City and Morton Street is 5,780 feet each, and the interior diameter of the twin tubes is 15 feet 3 inches, and the exterior diameter 16 feet 8 inches. There will be a single track in each tunnel, with concrete walks on the sides, to be used in case of a breakdown. Electric traction will be used, and the westbound, or cars going to New Jersey, will run through the north tunnel and the eastbound cars coming to New York will pass through the tube just opened.

The island of Manhattan and the eastern shore of New Jersey are now connected by giant twin iron tubes, through which, in two years at the furthest, passengers will be carried under the bed of the river, under the streets of New York, and into the very heart of the metropolis, and in far less time than is required to-day to transport them by the fastest ferryboats from shore to shore.

The opening of the south tunnel was celebrated in the afternoon by a trip of the president and directors of the tunnel company and a party of newspaper representatives through the tunnel. W. G. McAdoo, president of the New York & New Jersey Tunnel Company, was the host.

The tunnels now constructed are being extended to Sixth Avenue at Christopher Street, from which point subway lines will be built up Sixth Avenue to Thirty-third Street, and across the city to Astor Place.

Two additional tunnels are also under construction from Jersey City to the heart of the down-town district at Church and Cortlandt Streets, and work is about being begun on a connection on the New Jersey side of the river between the two sets of tunnels.

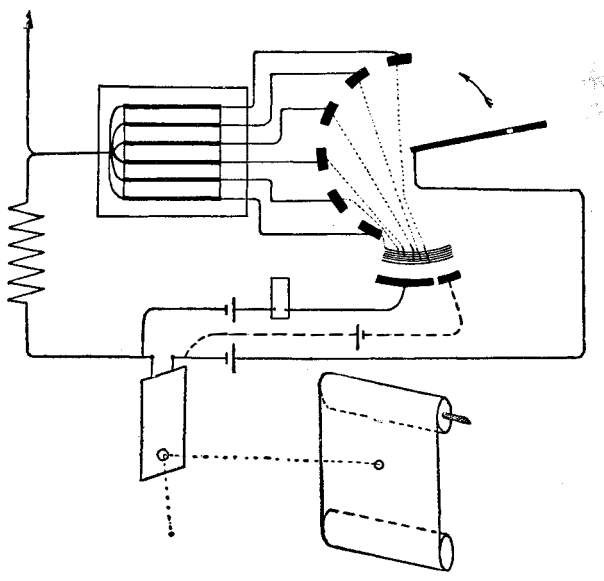
In the future a system will be completed whereby those living in nearby cities and towns of New Jersey, as well as those arriving from distant points by the steam railways terminating at the New Jersey water front, will be enabled to reach the very center of either up-town or down-town New York by safe and comfortable access, at a great saving of time, and freed from the dangers and uncertainties due to fog and ice, or the many other hazards incident to a crowded waterway.

AN APPARATUS FOR OBSERVING AND AUTOMATICALLY REGISTERING THUNDERSTORMS.

An apparatus intended for observing and automatically recording thunderstorms was recently described by Prof. A. Turpain to the French Physical Society. It consists of a set of seven coherers of graduated sensitiveness, connected with an antenna. One of the coherers, viz., the most sensitive, is placed in a circuit closed through a Claude relay, while the remaining coherers, which are of gradually increasing sensitiveness, are arranged in open circuits, so that their sensitiveness is reduced in a constant proportion.

As an atmospherical discharge acts on the apparatus, the starting coherer (not shown in the diagram) produces a current serving to disengage the apparatus, when a rotating commutator driven by a weight is allowed to perform a whole revolution and to return to its zero position. During the time the commutator is rotating, the connection of the antenna with the coherers is discontinued, thus avoiding any influence of atmospheric discharges, liable to interfere with the records. The duration of the rotation is by the way reduced to a minimum.

While performing its revolution, the commutator



AN APPARATUS FOR RECORDING THUNDERSTORMS.

will perform the following operations: 1. It will introduce successively the six coherers of graduated sensitiveness into the circuit of a highly sensitive galvanometer, allowing the successive deflections of the latter to be recorded photographically on a moving sensitive plate. 2. It will decohere the coherers on which a hammer acts during a sufficient interval of time. 3. It will throw a checking current of opposite direction to the recording current into the galvanometer through the coherer. This current enables the decohering of the coherers to be checked, thus ascertaining whether the ensuing records are to be counted.

The intensity of electrical discharges of atmospheric origin is thus automatically and successively recorded by the number and magnitude of the deflections registered, thus enabling the intensity of the discharges during a thunderstorm to be recorded from a distance, in terms of time. A Richard recorder enables the moment of the discharges to be registered as they follow one another.

The Current Supplement.

The current Supplement, No. 1553, opens with a splendid article, very fully illustrated, on the Just process of making dry milk. How carbon rods and plates can be made at home, is told in an instructive article by the late George M. Hopkins. Capt. R. H. Bacon, of the British navy, writes on the causes of accidents to submarine boats, a subject which is of considerable importance to naval men when the frequency of accidents to submarines is considered. Prof. John Stone Stone contributes an excellent discussion of interference in wireless telegraphy. A novel coil-clutch reversing gear is described by the English correspondent of the Scientific American. The turbine steamer "Manxman" is equipped with an electric steering gear which is decidedly novel from many points of view. The gear is very fully described. Dr. William Stirling writes thoughtfully on breathing in living beings. Everything connected with Japan has a heightened interest for us at present. For that reason an article on Japanese heraldry in the Supplement is particularly timely. The article is well illustrated with Japanese heraldic devices. Sir William Crookes concludes his paper on diamonds.

The Long-Distance Balloon Race from Liege.

The recent long-distance balloon race from Liege resulted in a victory for the English competitor, "Vivienne III.," carrying Mr. Leslie Bucknall and Mr. Stanley Spencer. Owing to the unpropitious weather only three vessels started. The English aeronauts had an adventurous journey, the most remarkable circumstance being that for the major part of the journey an altitude of over 16,000 feet was maintained, which constitutes a record height for a balloon under such circumstances. At the time of the ascent the wind was blowing at 30 miles an hour, but the aeronauts decided to reach a high altitude quickly so as to get above the clouds into an anticipated stronger wind. This was reached at 9,000 feet where a terrific wind velocity was encountered, and even at the maximum altitude attained (16,000 feet) the wind was blowing at 50 miles an hour. At 9,000 feet the aeronauts had an unusual experience. At the ascent the wind was blowing from the northeast, but at 9,000 feet the aerostat began to lurch and oscillate most violently, as it had entered a current blowing from the southwest at 50 miles an hour. As the balloon passed from one current to the other there was a violent shock, causing it to heel over to an alarming degree, while the aeronauts, with the car almost horizontal, had to cling tenaciously to the car until it once more regained its vertical equilibrium in the higher current. Even at the altitude of 16,000 feet the aeronauts could distinctly hear the clanging of machinery and the roar of the blast furnaces when passing over the Belgian and German iron districts. At nightfall the aeronauts descended below the clouds to ascertain their bearings, as they were traveling rapidly toward the North Sea. They discerned below a large city, and deeming it wise to descend, as they were uncertain of their true position, came to earth near a small village which proved to be Julich in the Rhenish provinces. Owing to the cross air currents, they had crossed and recrossed the River Rhine during the journey. This proved to be the greatest distance covered by a balloon in the race.

A Stock-Broker's Wireless Automobile Telegraph Station.

Considerable interest has been aroused in the latest development of the wireless telegraph, which, according to newspaper accounts, consists in the installation of an apparatus of this character in the automobile of Major W. R. Wetmore, a wealthy resident of New York city and of Allenhurst, N. J. The object of the experiment is to enable Major Wetmore, who, while largely interested in active stocks, is fond of making short trips about New Jersey in his touring car, to keep in constant touch with his brokers in the city.

The wireless transmitting station is located in the railway depot at Allenhurst, and from here the messages are relayed to and fro between the automobile and New York, the regular telegraph agent acting at the same time as wireless operator.

While the apparatus is rather crude, it is claimed that messages can be sent for distances of several miles, and that even then the signals are clearly heard. The receiving and transmitting antennæ consist of wooden uprights and cross-bars, strung with copper wire. They are secured respectively to the roof of the station and the top of the covered touring car. The rest of the apparatus differs little from the usual small outfits. Ordinary telephone receivers are employed for hearing the telegraphic signals.

Artificial Pumice Stone.

While emery is used for polishing tools, polishing sand for stones and glass, ferric oxide for fine glassware, and lime and felt for metals, pumice stone is more frequently employed for polishing softer objects. Natural pumice stone presents but little firmness, and the search has therefore been made to replace the natural product with an artificial one. The Schumacher factory at Bietighein, Germany, has produced an artificial stone by means of sandstone and clay, designed to be used for a variety of purposes. No. 1, hard or soft, with coarse grain, is designed for leather and waterproof garments, and for the industries of felt and wool; No. 2, hard and soft, of average grain, is designed for work in stucco and sculptors' use, and for rubbing down wood before painting; No. 3, soft, with fine grain, is used for polishing wood and tin articles; No. 4, of average hardness, with fine grain, is used for giving to wood a surface previous to polishing with oil; No. 5, hard, with fine grain, is employed for metal work and stones, especially lithographic stones. These artificial products are utilized in the same manner as the volcanic products. For giving a smooth surface to wood, the operation is dry; but for finishing the product is diluted with oil.

Correspondence.

The Recent Elevated Accident in New York.

To the Editor of the SCIENTIFIC AMERICAN:

The New York Elevated should have some method of announcing trains to junction points, as when trains are late, they do not always come in rotation. Then the trainman would not have to depend on the signals displayed on the motor, which are useless in foggy weather. They might be announced by telegraph or telephone. The telegraph is safer, as a telephone will not, of its own accord, make a sufficient distinction between words of similar syllables. As yet the telephone has not reached that stage of perfection where it supersedes the telegraph in dispatching trains. It is used to some extent on electric lines, but is not generally considered a success, often causing frequent delays and other inconveniences. The B. & M. R. R. terminal in Boston have a perfect system of announcing trains from tower to tower by telegraph.

F. H. SIDNEY.

Wakefield, Mass., September 30, 1905.

The Center of an Aeroplane's Gravity.

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of September 9 a writer suggested that aeroplane designers should place the operator, motor, etc., at quite a distance below the supporting surface, to prevent the machine tipping over.

I have made a number of aeroplane models, and have obtained a flight of over two miles, with a model weighing 4 pounds, spreading 5 square feet of wing surface, and with the center of gravity about 1 inch below the center line of the wings, by flying as a kite and then breaking the string. The model had an automatic arrangement that altered the angle of the wings when the machine was struck by a gust of wind.

I have never been able to make a model keep right side up that had the center of gravity much below the wings, as when it was struck by a side gust, the machine would be blown over.

The failures of Langley's, Lilienthal's, and Montgomery's machines were caused by some part of the apparatus breaking, and not by the failure of the aeronaut to maintain the machine right side up.

In all the aeroplanes that have achieved any success, the center of gravity is not much below the supporting surface.

FRANK N. EDIE.

Knoxboro, N. Y., September 18, 1905.

Do Animals Reason?

To the Editor of the SCIENTIFIC AMERICAN:

For many years I have been benefited by reading your valuable paper, and hope to profit by it for many years to come. I have been a silent reader all the time, and perhaps it would be better for me to remain silent. But becoming intensely interested in your articles on the subject, "Do Animals Reason?" will you permit me to say a word?

Do all domestic animals reason? Certainly they do beyond a question, and most assuredly do fowls also. Yesterday I rearranged the perches for my chickens. The old cock of the flock did not like my decision where I would have him roost, and made up his mind to have his way. He carefully eyed several limbs on near-by trees; finally he found a limb he believed he could fly to and catch. He stretched his neck, stepped right and left, felt well for a good footing, carefully measured the distance again and again, and finally made the effort, catching the limb with his bill, but finally fell to the ground. But he knew he could succeed, and did so with the next attempt. He measured the distance as accurately as my thirteen-year-old boy did when I asked him this morning how far he could jump.

Was it my boy's instinct or reason that failed him? How was it with the rooster?

I have a very sensible mare which, quite often, I drive single to the buggy. On one occasion, in winter, I traveled a country road where a large creek crossed. The water was some thirty yards wide covered with ice about three inches thick. I was at a great loss what to do, but I must go. Just what would happen I could not tell. I gave "Nettie" to understand she must take the ice. She did not like my decision, and gave me to understand as much. But I urged her to make the effort. She cautiously walked upon the ice about her length, when the ice broke. The water was about two feet deep, and a sheet of solid ice before her. I am sure I was more excited than my animal was. I felt I was in serious trouble, and could see a wrecked buggy and harness before me, with perhaps a crippled and cut animal that I valued very highly. I hesitated what to do next, and was quite anxious. To my astonishment, my animal reared on her hind feet, reaching forward with her forefeet and bringing them down with great force, breaking the ice in many pieces, then rose with both hind feet, throwing them forward and bringing them down with immense force, further reducing the ice to pieces. This operation was repeated many times, going forward each time, until the opposite side of the creek was reached in safety. Was this instinct or reason? It certainly was not imitation.

I assure you I feel the effect of this act until this day. Had I acted with a reasonable instinct, and so secured an ax or some suitable instrument and broken the ice for my animal, I would not have felt so insignificant in the presence of my buggy mare.

DR. E. C. TAYLOR.

Exeter, Mo., September 6, 1905.

Time for Another Principia.

To the Editor of the SCIENTIFIC AMERICAN:

In your paper of July 15, you have an editorial entitled "Time for Another Principia," from which I quote:

"These are surely the corpuscles of electricity exploited by Thomson. For three years the floods of mail received here, letters, essays, pamphlets, books, everything, have one inevitable trend and tendency, and that is: The universe rests on an electrical base. In other words, nothing exists but electricity. This doctrine comes here from all directions. This universe is now maintained by 'action at a distance;' that is, radio-activity is its sole support. There is not a trace of a new idea in this."

To the concluding sentence of this quotation, where you say there is nothing new in this idea, I wish to reply by giving you and your readers some new ideas.

While none of us know all of the wonders as set forth in the recent discoveries in radio-activity, and while you state that "the universe rests on an electrical base; in other words, nothing exists but electricity," I wish to differ from you in that respect, and submit the following ideas upon electro-magnetism, built from years of research and experiment, not only upon metals, but upon the human system, and observations of vegetable matter. I am led to believe that magnetism is the primary element of creation, and not electricity.

For the purpose of illustrating my idea I will use a dynamo, the armature of which represents our sun and the field magnets represent the planets of our solar system. Dynamos are built of sufficient diameter and have as many field magnets as there are planets in our system, each magnet acting upon the armature and the armature reacting upon all of the magnets, each renewing its power from the action of the others. We all know that the amount of electricity and magnetism developed depends upon the speed of the armature; that is, increase the speed of the armature 25 per cent and you get 25 per cent more current. Therefore, carrying out our illustration, each planet is a field magnet for the generation of magnetism for all of the others, by which each, independent of the others, generates an electric current for its own local use. Is it not, therefore, a self-evident truth that since there are large bodies of iron ore in the earth and the spectroscopic lines find the same elements in the sun and other planets, residual magnetism exists in the other planets the same as in the earth?

Therefore, if a planet did not rotate on its axis, it would still be charged with a large amount of the energy which we call magnetism. Now if we compel that planet to rotate on its axis, it causes the development of an element that did not exist on that planet before it rotated. This generation of a new species of energy is called electricity, and with the development of this new-born son of light and labor, it causes the planet to begin immediately to generate a much larger amount of magnetic intensity, or speaking in the language of mechanics, its invisible magnetic steel cables are doubled and trebled in strength and size and power to do work for itself and its neighboring planets millions of miles away.

We lay down the proposition that magnetism was and is a natural primal element that existed in the metals of planets from the dawn of their creation. Though the planet, if it is possible to imagine such a contingency, may not have rotated on its axis for millions of years, it still had its storehouse of dormant magnetic life and power, whose unseen lines of force were reaching out into all the regions of space and searching for the polar affinity of its brother orbs with a pulling power that is inconceivable to the human brain. These lines of magnetic force, we will say for the purpose of our argument, are holding this non-rotative planet in their vise-like grip, floating at rest in space, very similar to our moon, which rotates upon its axis but once a month if at all. Therefore, when we apply an irresistible rotating power and compel it to rotate on its axis, there occurs what we can call a tremendous friction. These millions of lines of unseen magnetic force, stronger than steel cables, object to this new motion; they say to this planet: "What is the matter with you? Can't you keep quiet and not kick up such a racket?" But the rotating power is more mighty than the holding power, whereupon begins the bending, stretching, and warping of these lines of force, and this new element we call electricity is born of the struggle between these two giants, magnetism and the unknown rotative power. After the struggle and birth of electricity, magnetism received its younger brother with open arms and we call the twins by the name electro-magnetism.

Incidentally, we would remark that the energy which keeps the planets rotating on their axes is apparently a different power from that of magnetic force. Who knows what that energy is? The only reply we can make is to call it infinite energy.

Can we not illustrate this idea by an equation in mathematics where we have two given and known quantities, magnetism and electricity, and one unknown quantity which is superior to both of the others, and solve this problem by using the dynamo? There it stands, idle; its armature not moving, but we know that it is ready to generate a given quantity of both magnetism and electricity. Before it can do this we must compel the armature to revolve, which it cannot do of itself, but requires another energy (our unknown quantity). This unknown quantity must be more powerful than the other two; therefore we apply a 2,000-horse-power steam engine to the shaft of a 1,500-horse-power dynamo and immediately the object of the creation of that dynamo is complete; the armature revolves; results are given out. Therefore, I ask, is there not still another force left for men to discover and develop for the use of humanity—this unknown power which compels the planets to rotate against the lines of magnetic force?

Therefore, have we not reason to believe that magnetism is an absolute element of original creation and that electricity is the result of that purpose carried to its complete perfection?

The first was required by its pulling power to keep each planet in its destined path. The second was not needed until the Creator said, "Let there be light, and the evening and the morning were the first day," viz., the earth commenced to rotate.

What affinity there may be between radium and magnetic lines of force I am not prepared to say. We know each one penetrates all substances and cannot be insulated. That there is some affinity between them I am ready to believe, and to deny that there is any affinity between radium and electricity until the time comes for a forming planet to rotate. Then only does electricity appear entirely as a local matter that does not pass away from the periphery of the earth or other planet only in so far as the moisture of the air extends above or beyond that planet.

To establish my position I refer again to the moon, where no electricity exists as far as our ablest scientists have been able to discover. That it has a tremendous pulling power, we see by the tides of the ocean. If it is not magnetism that draws the ocean in its path, what is it? It is not needful to say that magnetic power requires neither water nor wet earth. That there is radium in the moon, we have every reason to believe, but as yet cannot prove it; while the lack of water is absolute proof that there is no electricity on the moon. Therefore, if there is no electricity on the moon, the statement that "the universe rests on an electrical base" is not correct, for we know not how many other dead planets like the moon exist in the universe.

No doubt there was a time in the life of the moon when it was surcharged with water vapor and electricity; then did it not rotate on its axis as fast as does the earth? There are some things scientific investigation has not yet revealed; one of them is why a planet stops rotating and dies, thereby losing its vapor and electricity.

I have tried to express my ideas in as few words as possible; a volume could not tell all on the subject.

BENSON BIDWELL.

Chicago, Ill., August 10, 1905.

International Polar Exploration.

The International Congress on Economic Expansion, at its session at Mons, discussed a plan for placing polar exploration under international direction. A motion to this effect was signed by the Duke of Abruzzi, the Duke of Orleans, Dr. Charcot (the French Antarctic explorer), Lieut. Gerlache (the Belgian Antarctic explorer), Dr. Nordenskjold (the Swedish Arctic explorer), and many others. The signers are said to be certain to have the adhesion of Commander Peary and Dr. Nansen, and practically all the Arctic explorers. It was stated by those present that Dr. Nordenskjold, Lieut. Shackleton of the British navy (the Antarctic explorer), and W. S. Bruce were ready to take part in an international expedition. A motion was adopted approving the plan for international direction of polar exploration and asking Belgium to take the initiative in inviting the other nations. The congress also adopted a proposition for the creation of an international ethnographic bureau for the purpose of assembling the information gathered by all scientific missions. Frederick J. V. Skiff of Chicago was among the supporters of the proposal to establish the bureau. A committee was appointed to organize it. The political section discussed trusts and tariffs and adopted a motion calling on the various governments to introduce legislation for the control of industrial combinations. M. Beermaert, Minister of State, addressed the marine section upon the necessity for an international agreement upon maritime legislation.

THE VANDERBILT CUP ELIMINATION RACE.

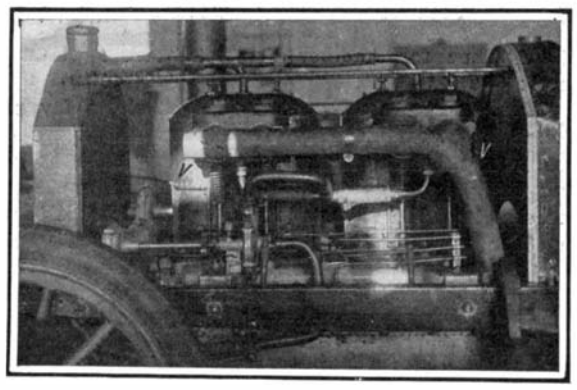
The leading machines in the elimination race for the selection of the team which is to represent America in the Vanderbilt cup contest, were, as reported in our last issue, a Pope-Toledo 60-horse-power machine, a 120-horse-power Locomobile, a 40-horse-power Royal Tourist, a 50-horse-power Haynes, and a 60-horse-power Thomas. The two leaders and the last are racing machines, built specially for long-distance racing of the class to which the forthcoming race belongs; the other two are stock touring machines. Among those that failed to get placed were three racing machines—a 90-horse-power Pope-Toledo, a 40-horse-power White steamer, and a 60-horse-power Christie; the first two having been built specially for this race, and the Christie racer being the one that has this year done such good work in the Florida and Cape May races.

The Vanderbilt Cup Commission, before the race was held, announced that they reserved the right to select other cars than those which might win, should it appear to them that the American team would be strengthened thereby. In accordance with this policy, they decided to substitute the White and Christie machines in place of the touring cars, and the 90-horse-power Pope-Toledo in place of the 60-horse-power Thomas. The chairman of the committee explained that the members felt that the two touring cars which showed an average speed of less than fifty miles an hour, would have but little chance of winning in a race in which, because of the faster course, the average speed was likely to be between sixty and seventy miles an hour; while they considered that the 90-horse-power racer with a driver like Lytle, with experience in road racing, would be a better combination than that afforded by the lower-powered Thomas car and its less-experienced driver.

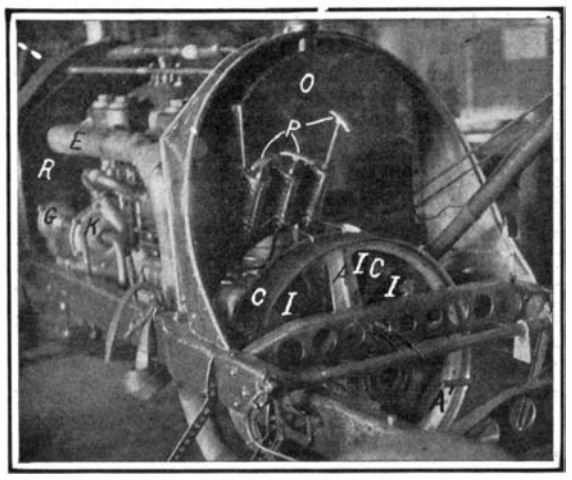
That the failure of the three winning cars to be selected for a place on the team should be a great disappointment to their owners and builders was inevitable; for it cannot be denied that, although their average speeds of 48.79, 47.44, and 46.26 miles per hour would not give much expectation of their winning against the fast and powerful foreign machines that are entered, the performance was an extremely creditable one for machines that were built merely for touring purposes.

In any case, it is gratifying to note, as the result of the race, that America stands in a much stronger position this year than she did last; for there are at least eight machines that may be considered strong candidates for a place on the American team, namely, the five that finished first in the trials and the three which were subsequently selected by the cup commission.

Our illustrations show eight of the ten machines which competed on the 23d ultimo. The only two not shown are the 60-horse-power Franklin (whose lengthy eight-cylinder air-cooled engine, however, appears upon page 282) and the six-cylinder, 90-horse-power Pope-Toledo, which broke a transverse member of the subframe that supports the engine and transmission, during the second circuit. The winning Pope-Toledo No. 2, with Dingley at the wheel, is shown at the starting line, which it crossed at 5:32 A. M. This machine finished its first round at 5:59:58, thus covering the 28.3-mile circuit in 27:58, or better than a mile a minute. This was the fastest time made by any machine. The other circuits were made in 31:07, 33:35, and 28:10 respectively, and included two stops on the second and two on the third round. The first three stops were occasioned by broken vibrators and were of short duration, while the last one was caused by dirt in the carbureter, which it took about five minutes to clean out. The first and last round were made without a stop. The four-cylinder engine of the Pope-Toledo car is also shown herewith. It has the same type of corrugated copper water jackets that have been used on the Pope-Toledo machines for the past several years. The explosion chambers on top of the cylinders are high and of small diameter. They contain the inlet and exhaust valves, the former of which is located above the latter and is automatic. The spark plug is seen in the head. A belt-driven, mechanical, force-feed oiler



Exhaust Side of the 7¼ x 7¼ 4-Cylinder Locomobile Engine, Showing Copper Water Jackets at V V.



AA, clutch cone; III, blades of flywheel; CC, protective casing completely inclosing forward side and rim of flywheel; O, oil tank; P, oil pumps; E, exhaust pipe; R, radiator; G, incased half-speed gear on same shaft with water pump; K, centrifugal water circulating pump.

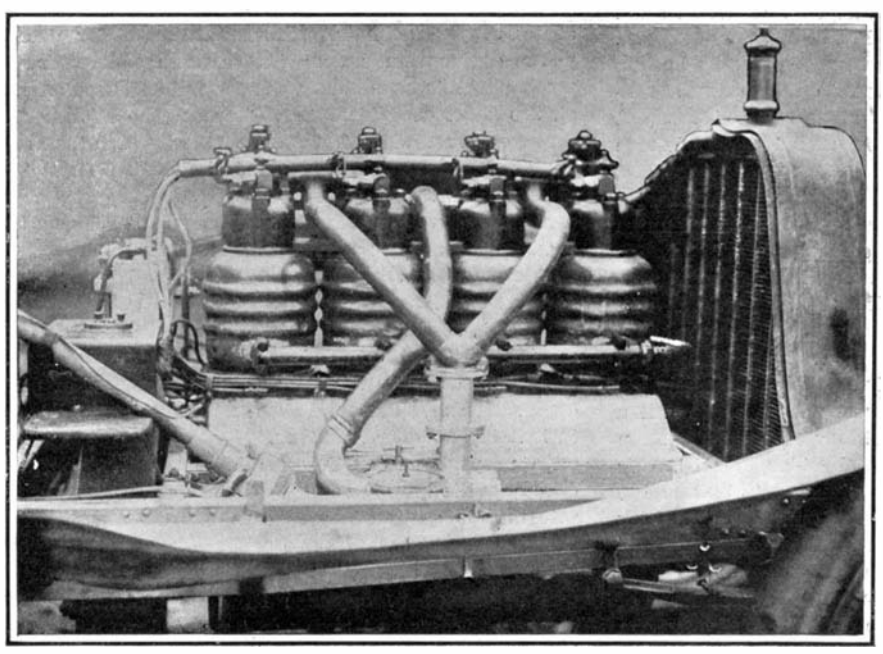
Rear of Dash of Locomobile Racer, Showing New Oiling Arrangements and Casing for Flywheel Clutch.

supplies oil to the engine cylinders and crank-case. A single carbureter, of the automatic float-feed type, supplies all four cylinders. The gasoline is pumped by hand from the main tank to an auxiliary tank just above the carbureter. A separate coil, high-tension ignition system with accumulators is used. The engine has 6 x 6-inch cylinders and it develops maximum power at 1,000 R. P. M., at which speed the car, which has a three-speed transmission, travels 78 miles an hour. The car differs from the regular model touring car chiefly in that the frame is shorter and that smaller tires are used on the front wheels. These are 3½ x 34, while those on the rear wheels are 4½ x 34. The wheel base is 96 inches, and the weight 2,198 pounds. The six-cylinder Pope-Toledo has cylinders of the same size as the other car, but two carbureters are used instead of one. This car is geared to make about 92 miles per hour at 1,000 R. P. M. of the engine. It has a 100-inch wheel base and weighs 1,000 kilogrammes (2,204 pounds), which is the limit.

No. 1, the Haynes, made a very steady-running performance, and except for an oil can falling into the flywheel, had no troubles whatever. Its driver was sending it over the course faster every round when the race finished. This machine has several improvements, including an arrangement for passing from high to low gear at once without releasing the clutch. It also has a special roller bevel-gear drive. The wheel base is 106 inches and the wheels 34 x 4 and 34 x 4½. The car weighed 2,198 pounds.

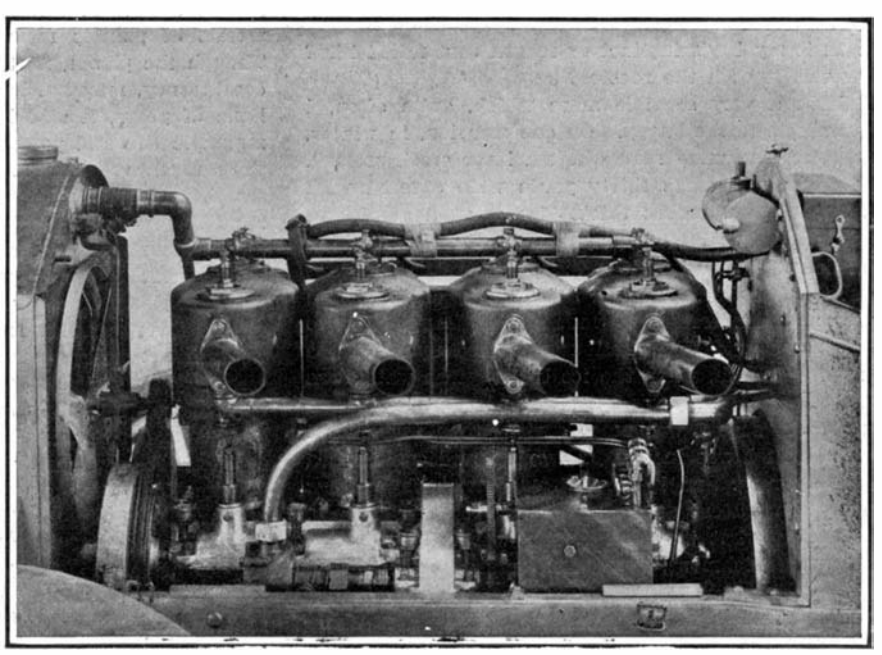
Car No. 3, a large Matheson touring car chassis of 40 horse-power, as well as the front end of No. 4—the White steamer—is shown at the starting line. No. 3 quit in the first round from a crank-shaft bearing seizing, and No. 4 did even worse, for Walter C. White, who was driving it, opened the throttle too suddenly, with the result that one of the universal joints of the longitudinal driving shaft broke as the car went over the line. The machine coasted down the slight grade a short distance and stopped at the side of the road. During the next half hour a universal joint was taken from a touring car which stood beside the road, and the racer was repaired. It reappeared at the start 1 hour, 7 minutes, and 52 seconds after it first crossed the line. On the second round it was put out of the race by the water tank breaking. The tank had been damaged in an accident which occurred the previous day.

The present White racer is built along somewhat the same lines as the former one with which Webb Jay set the world's track record for the mile at 48 3-5 seconds. The engine and generator in the new car are more powerful, and the machine is built heavier throughout in order to make it suitable for road racing work. It also has larger tanks for the storage of gasoline and water, and it is, furthermore, equipped with a condenser which extends along both sides almost half the length of the car. The car sets very close to the ground, the springs and frame being below the axles. In every respect it looks like a powerful racing machine. The wheel-base is 132 inches, the front wheels have 3½ x 30-inch tires, and the rear wheels 4½ x 34-inch. As in the touring car of the same make, the frame is of armored wood and there is a shaft drive with disconnecting clutch from engine to rear axle. In the extreme front of the car is the water tank; then comes the generator, similar in every respect, except size, to that used in the White touring car; set close behind this is the vertical, compound engine, which also differs only in size from a stock engine. There is a high, square dash, and the driver and his assistant sitting behind this are almost completely protected by it, only their heads being visible from the front of the machine. On the rear of the car are twin gasoline tanks, which, as well as the water tank, have a capacity of 30 gallons. The weight of this car is 2,184 pounds. No. 5, the Locomobile racer, probably was capable of the greatest speed of any machine entered, for its engine was by far the largest, and has developed under test well over 120-horse-power. Joseph Tracy, who drove the huge machine both here and in the last Bennett race in France, used every precaution in order to make a good showing. He traveled the 113 miles without a stop, and covered the circuit in two minutes less time the last two laps than he took for the first two. His times were 31:27, 31:13, 29:56, 29:13 for the four laps. A variation of but 14 seconds in going 28.3 miles certainly shows very skillful driving. Tracy tried to make the rounds in 30 minutes each, and how well he succeeded is shown by the above figures. This racer has had necessary changes made in it since the Bennett race. The chief of these is the complete



The 60-Horse-Power 6 x 6-Inch Engine of the Pope-Toledo Car.

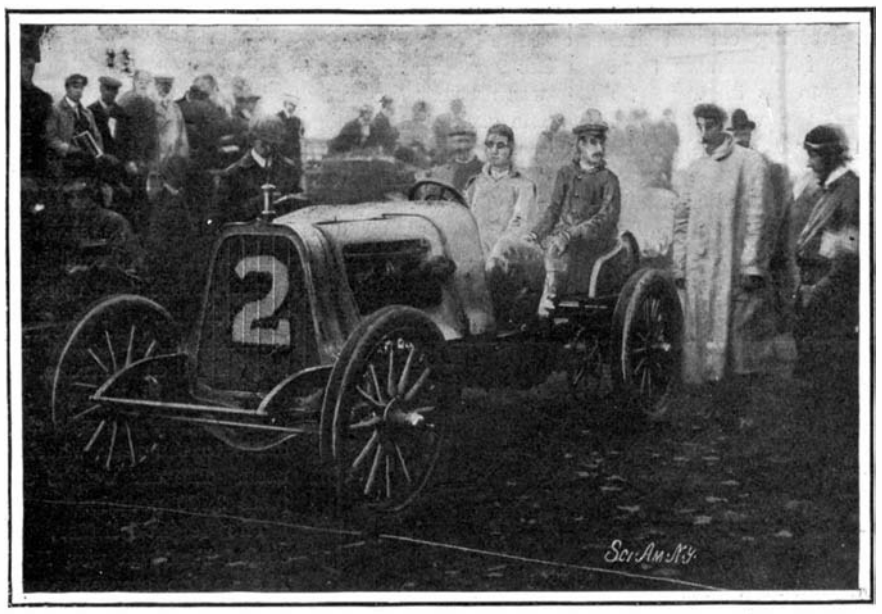
This view shows the corrugated copper water jackets and the automatic carbureter, as well as the spark coil lying horizontally on a board just over the flywheel. Note also the special radiator of this car.



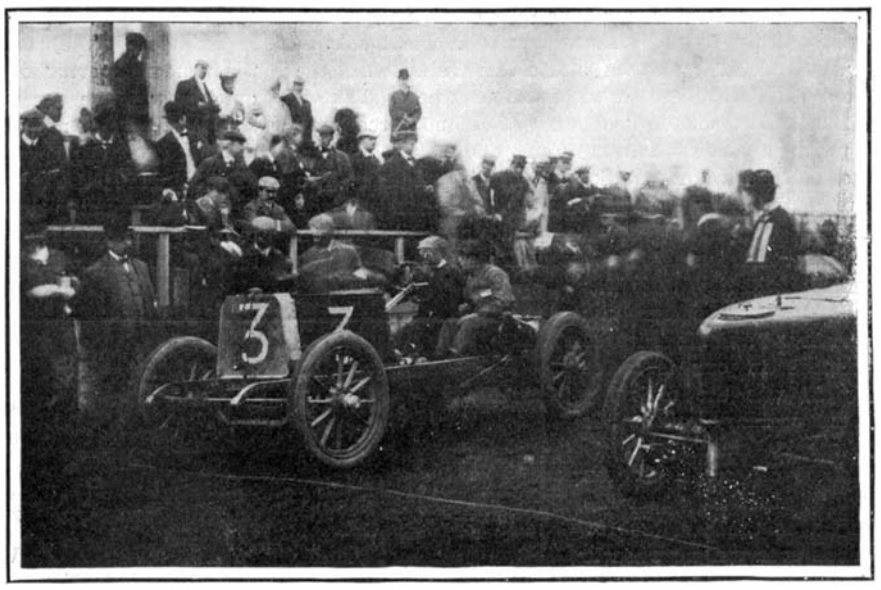
Exhaust Side of the 50-Horse-Power 5 x 6-Inch Haynes Engine.

The gear-driven pump, mechanical oiler, and belt-driven fan are clearly shown. Also an auxiliary oil tank and spark coil on dash.

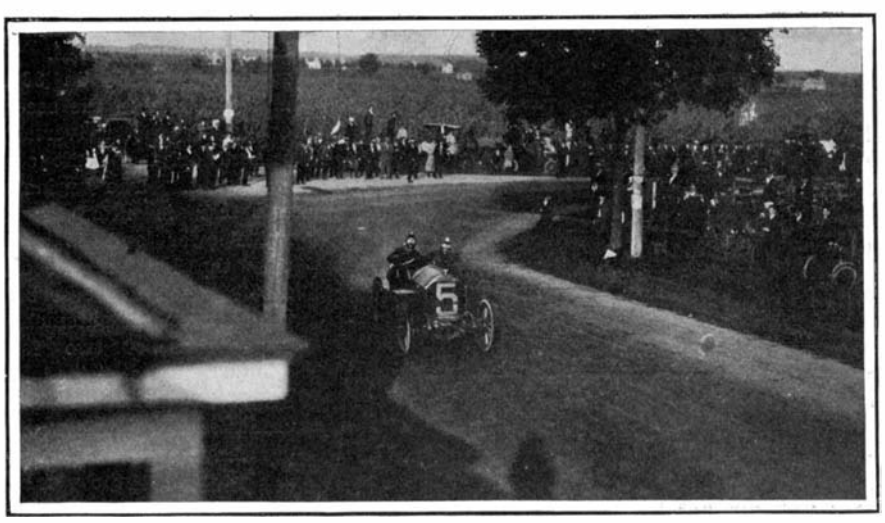
ENGINES OF THE COMPETING CARS IN THE VANDERBILT CUP ELIMINATION RACE



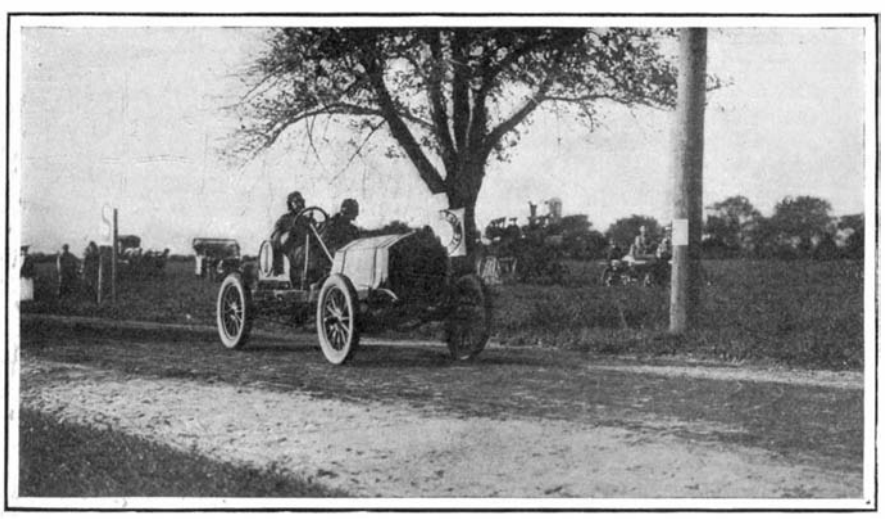
Start of the 60-H. P. Pope-Toledo, Which Won the Race in 2 Hours and 50 Seconds.



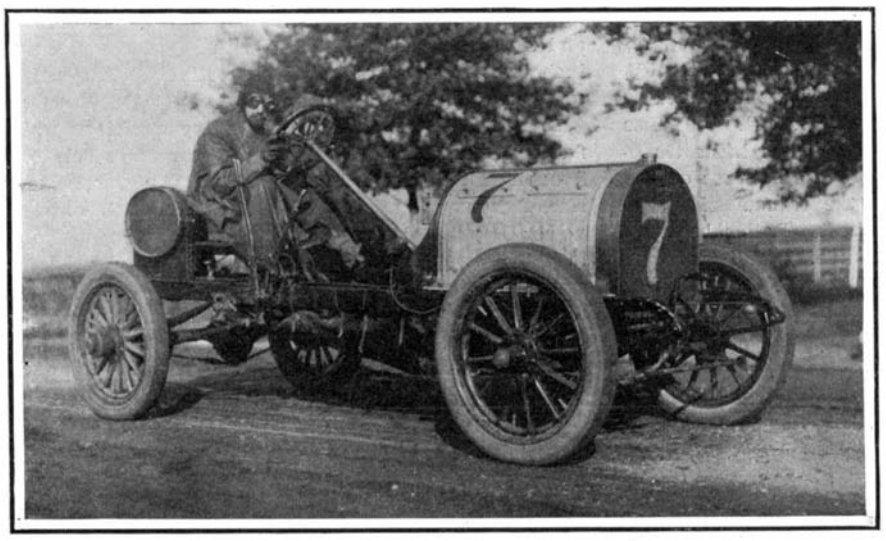
The 40-H. P. Matheson and White Steam Racers at the Starting Line. Neither Car Finished.



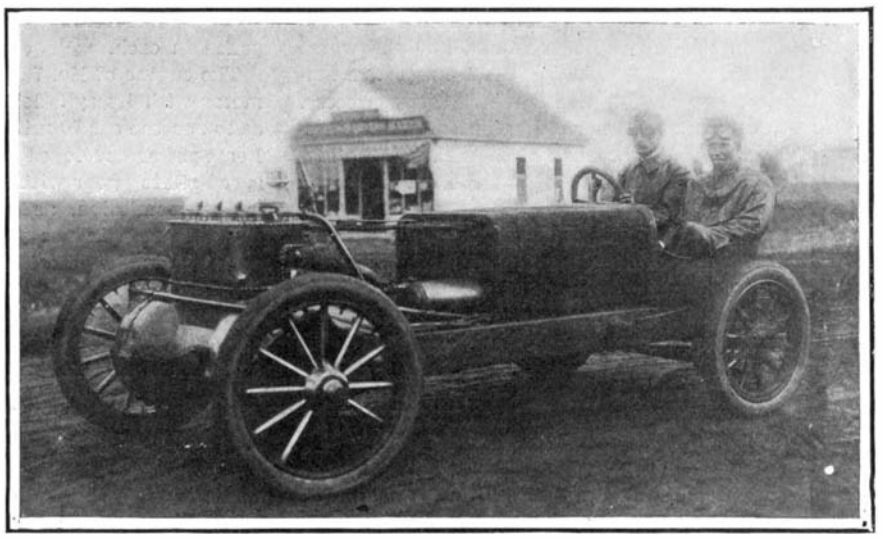
The 120-H. P. Locomobile Rounding the Hyde Park Turn. This Machine Made no Stops and Won Second Place in 2 Hours, 1 Minute, 49 Seconds.



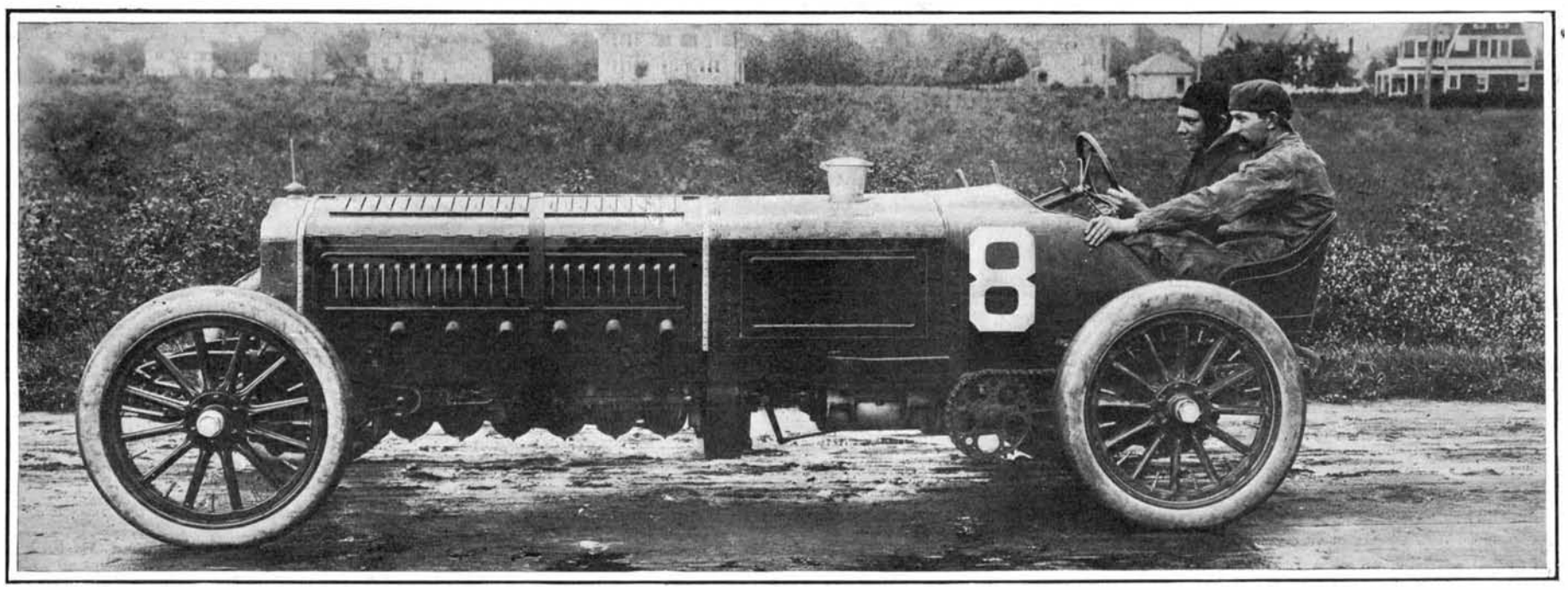
The 40-H. P. Haynes Speeding. This is an Improved American Touring Car Which Made a Very Consistent Performance and Obtained Fourth Place in 2 Hours, 23 Minutes, 32 Seconds.



The 40-H. P. Royal Tourist Which Overturned in the Third Round, was Righted Again, and Won Third Place in 2 Hours, 19 Minutes, 18 Seconds.



The 60-H. P. Front Drive Christie Machine Which did not Finish on Account of Tire Trouble, but Which has been Placed on the American Team.

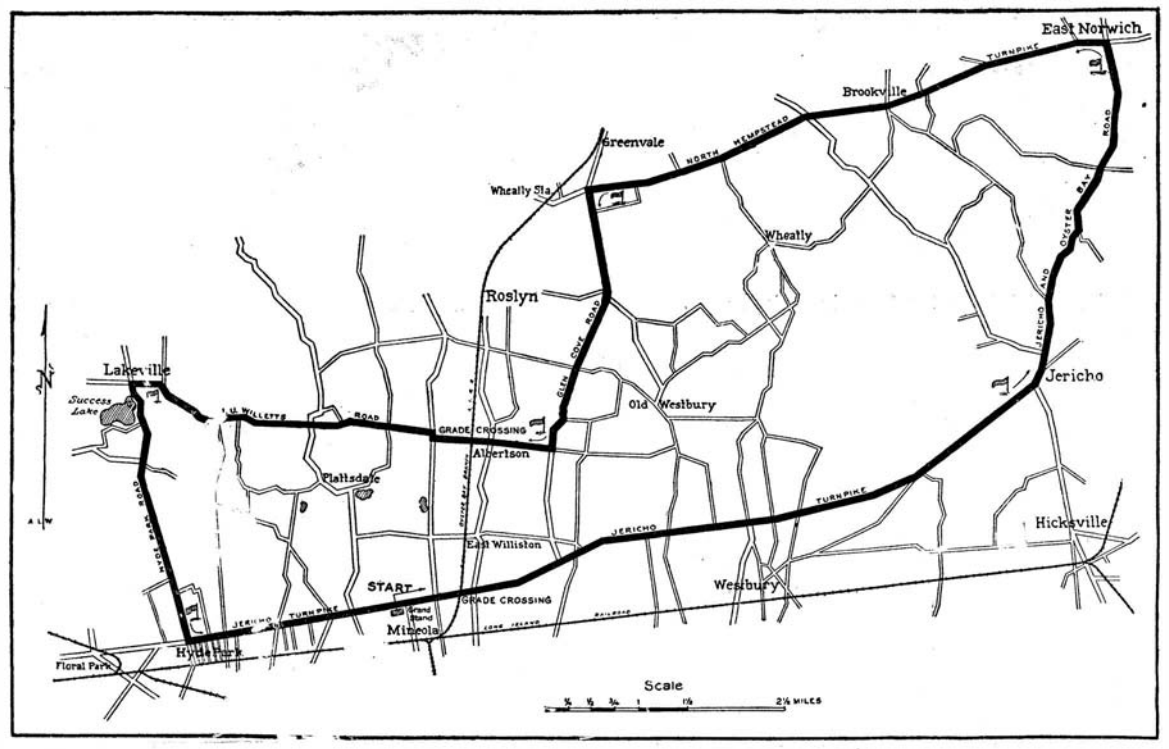


The 60-H. P. Six-Cylinder Thomas Racer, Which Made Good Time on the First Round, but was Delayed by Battery Troubles Afterward. This Car was Fifth in 2 Hours, 29 Minutes, 40 Seconds; but it was not Put on the Team, Being Replaced by a More Powerful Pope-Toledo.

MACHINES WHICH COMPETED IN THE VANDERBILT CUP ELIMINATION TRIALS.

protection of the clutch from oil by incasing it and the flywheel, as shown in our illustration. The tight casing around the flywheel is shown at *C C*. The blades of the flywheel, *I I I*, are seen within this casing, while the clutch cone, *A A'*, is seen within the flywheel. The oil tank is located on the dashboard at *O*, and three hand oil pumps are now used for forcing the oil to the bearings, cylinders, and crank case of the engine. The water pump is shown at *K* on the same shaft with the inclosed gear, *G*, which is driven by another gear on the motor shaft at half the speed of the latter.

Another change that was made before the car was sent abroad and since it was described in our issue of May 27 was the replacing of the ordinary cast water jackets by similar jackets of sheet copper. This was done in order to reduce the weight, as the car was 100 pounds over weight when it was completed. Nearly the whole 100 pounds were removed from the engine alone. Yet this made a perfect performance in both the Bennett race and the eliminating trial. In the view shown herewith, the reader will note the copper water jackets, *V V*, riveted to the engine. The engine is so geared that at 900 R. P. M. the car travels at a speed of 90 miles an hour on the high gear. It was the only engine fitted with low-tension ignition by magneto, and the car, too, was the only one to finish the race without a stop.



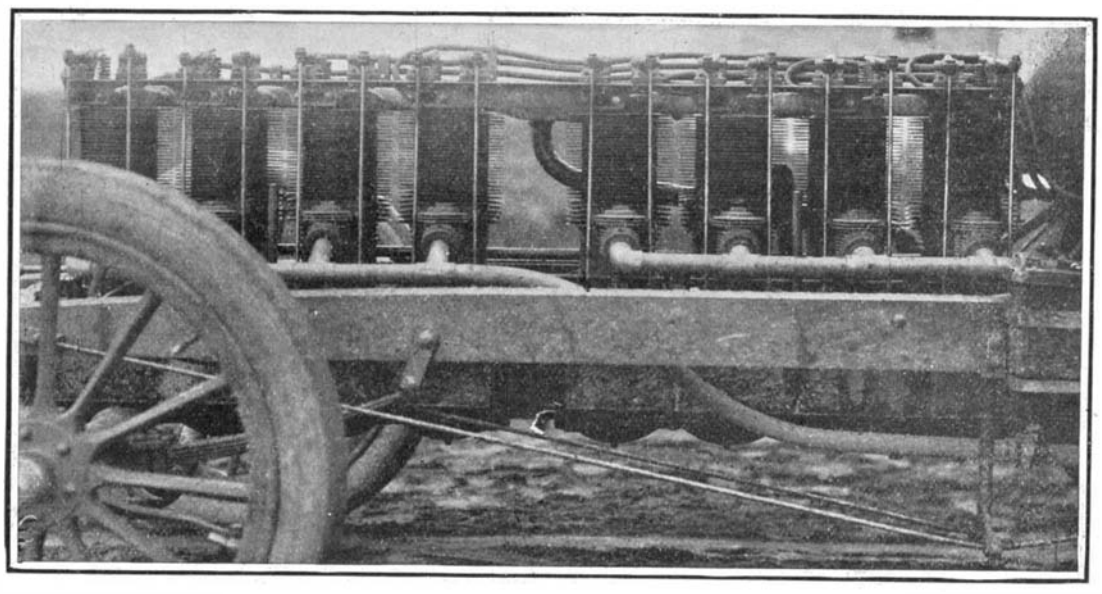
Map of the Course of the Vanderbilt Race.

The eliminating race was held over this course.

The Christie car, No. 6, has already been described at length in our last Automobile Number. It was driven by George Robertson, who had had scarcely any experience in driving it. As a consequence, the car swayed badly. The engine did not start easily at the starting line, and so it was set in motion by pushing the car and suddenly letting in the clutches. One of the front tires was not sufficiently inflated. It was ripped off at a turn in the first round, and the wheel was run on its rim 250 yards to the nearest tire station. Putting on the new tire was a lengthy process, as this car consumed 1 hour, 50 minutes, and 58 seconds on the first round because of the delay. The second round was made in 32:38; and the car appeared to have great speed as it passed the grand stand. In the Vanderbilt race it will be driven by Walter Christie, its designer and builder, and it will doubtless make a much better showing in view of what it has done in the past. The engine of this car is a 6¼ x 6¾ four-cylinder, water-cooled motor, the cylinders being in one casting which has a copper water jacket around it. As is apparent from the photograph, the engine is placed transversely in front and drives the wheels direct through cone clutches in each of its two flywheels and short, universally-jointed shafts connecting with the hubs of the wheels, and permitting them to be turned for steering. With a similar motor on the rear of his car, Mr. Christie made a mile at Atlantic City beach in 38 seconds (94.73 miles an hour), but in a subsequent trial the rear cylinders broke off at the base, fortunately without hitting either Christie or his mechanic.

The driver and mechanic of No. 7—the "Royal Tourist"—deserve great credit for what was without a doubt the pluckiest performance of the day. The car ran splendidly and without mishap until it was half way around on the third round, when it overturned at the sharp turn about 2½ miles northeast from the grandstand. Its driver, Robert Jardine (who also designed and built the car) took the turn at too high a speed. The road was soft at this point and the earth had been pushed up in a ridge at the edge of the turn. The car, as usual, tended to skid, but the moment the wheels struck the ridge (which held them from sliding further laterally) the terrific centrifugal force developed overturned it about its outer wheels as a pivot, and it fell upside down. Both men were thrown out but not injured badly. With the aid of onlookers they righted the car, straightened the bent steering column and levers as best they could, and in four minutes from the time it overturned it was again on its way. So quickly was the car righted that the water did not spill out of the radiator to any great extent or the acid out of the ignition accumulators. The nervy driver finished the third round without a stop, but he was obliged to stop twice for water in the fourth. The top cap was knocked off the radiator and the pump forced the water out, while the radiator was leaking besides. Despite the accident, the machine was only two minutes slower on the third than on the second round, which was the fastest. It was during an effort to go still faster that the accident occurred. The time by rounds was as follows: 34:44, 33:21, 35:36, 35:37. The last two rounds within one second of each other is a curious coincidence in view of what happened in each.

The engine of No. 7 is a typical four-cylinder, 5 x 5½ motor with its cylinders cast in pairs. It is geared so as to run the car 60 miles an hour at 1,000 R. P. M. The horse-power developed is 32 to 38. The car has a three-speed sliding gear with universal joints between engine and transmission, and between the transmission and the rear axle in the propeller shaft. Roller bearings are used in the wheels and rear axle. The former are fitted with 34 x 4½-inch tires. The wheel base of the car is 110 inches. This machine made an excellent showing and finished third, despite the fact that it overturned in the third round and that its driver and mechanic miraculously escaped serious injury.



The 60-Horse-Power, 5 x 5-Inch, Air-Cooled, Franklin Engine.

Note the auxiliary exhaust pipe at the bottom of the cylinders.

THE VANDERBILT CUP ELIMINATION RACE.

The six-cylinder Thomas racer was car No. 8. A good idea of the length of this machine (which has a 122-inch wheel base) is to be had from the illustration. This car would have made a far better showing had it not been for the breaking of the battery box which carried the two sets of accumulators. One of these upset and lost most of the acid as the car passed the grandstand at the beginning of the second round. Grant, the mechanic, held the battery between his feet until it was used up. Then a stop was made and the other battery was put in circuit. This too ran down and the last few miles were run on the low gear at 20 miles per hour in order to keep the engine running, as it was missing fire so badly from the weak battery.

The six-cylinder Thomas motor is made up of individual cylinders bolted to the crank case. The inlet valves are automatic and are placed directly over the exhaust valves. The spark plugs are located in the valve chambers. A distributor directs the secondary current from a spark coil with vibrator, to each of the six plugs in turn. Storage batteries are used to supply the current. The engine cylinders are 5⅜-inch bore by 4½-inch stroke. A three-speed sliding gear transmission and side chain drive to the rear wheels is used. The car weighs complete 2,180 pounds.

The eight-cylinder, air-cooled Franklin was No. 9. The engine started readily and ran with the clock-like regularity of most of the Franklin motors; but the machine did not accelerate rapidly and did not appear to have much speed. It made one round in 36:46 and gave out in the second owing to the universally-jointed driving shaft coming apart. The engine of this car is rated at 60 horse-power and is probably the largest air-cooled motor which has ever been placed upon an automobile. It consists of two four-cylinder units joined together and driving a single crank shaft. The cylinders have a 5-inch bore and stroke. All the valves are in the cylinder heads and are mechanically operated. An auxiliary exhaust pipe is fitted and connects with ports at the base of the cylinders, as can be plainly seen in the illustration. On account of the length of the motor, the car itself has a very lengthy appearance, while the driver's seat is raised exceptionally high. The wheel base of the machine is 128 inches, and the wheels used are fitted with 3½ x 36 and 4 x 36 inch tires in front and rear respectively. The weight of the machine is 2,180 pounds.

The total elapsed times of the five machines which finished were: No. 2, 60-horse-power Pope-Toledo, 2 hours and 50 seconds; No. 5, 120-horse-power Locomobile, 2 hours, 1 minute, 49 seconds; No. 7, 40-horse-power Royal, 2 hours, 19 minutes, 18 seconds; No. 1, 50-horse-power Haynes, 2 hours, 23 minutes, 32 seconds; No. 8, 60-horse-power Thomas, 2 hours, 29 minutes, 40 seconds. The average speeds of these cars in the order named were 56.54, 55.80, 48.79, 47.44, and 46.26 miles an hour. The first two of these times are a little better than the average time made by the winner, Heath, on his Panhard car last year. Although he traveled very much faster the first few rounds, he only succeeded in averaging 52.2 miles per hour on account of tire trouble. Thus it will be seen that only the first two cars made an average speed as great as that which will undoubtedly be averaged in the final race. The Thomas made 54.98 miles per hour in its first round, so that if its battery had been fastened on securely it would probably have made the third best average time. With the exception of the Christie none of the machines had tire trouble.

The race was hardly long enough to test thoroughly the endurance of tires and machines under high-speed conditions; but it is to be hoped that the lessons to be learned from it will be taken to heart by the owners of the cars chosen, and that as a result the American cars will make a fast and steady performance in the final race.

If the team remains as selected, it will consist of the following five machines: 120-horse-power Locomobile, 90 and 60-horse-power Pope-Toledo machines, 60-horse-power Christie, and a 40-horse-power White steam racer. The last two of these machines are distinctively American types, and all are purely racing cars.

GLIDING BOATS.—THE NAVIGATION OF THE FUTURE.

BY PROF. DANIEL BELLET, OF THE PARIS SCHOOL OF POLITICAL SCIENCE.

Every vessel of the ordinary type, even if of very light draft, is partly submerged, for it must displace its own weight of water, whether it be in motion or at rest. To use a figurative but very descriptive expression, it "plows" the water, separating its particles and forming a furrow. This plowing necessitates a continual expenditure of energy, from which, for example, a wheeled vehicle traveling over a smooth road is exempt. It is true that the building of boats has been carried to great perfection, and the forms of bow and stern are such that the water is parted with comparative ease and flows together smoothly astern. In the new auto boats, especially, both the bow and stern waves are nearly eliminated. But the resistance due to partial immersion remains, and forms the greatest impediment to progression, far exceeding the skin friction. It is because of this resistance that the power required to propel a vessel varies as the cube of the velocity.

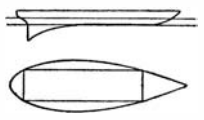
Hence inventors have long sought the realization of a type of vessel which shall not penetrate but glide over the water, thus eliminating all resistance except the skin friction on the bottom. The best method of attaining this result is to give the vessel so great a speed and such a form that the propelling force is resolved into two components, one of which sustains the weight of the vessel. This is the principle of Count de Lambert's remarkable boat, before describing which, however, I will mention some earlier attempts.

The idea of the gliding boat seems to have been suggested by the children's pastime of "skipping" stones on ponds. The stone, like the boat, has weight, which is sustained by the decomposition of its momentum on oblique impact against the water.

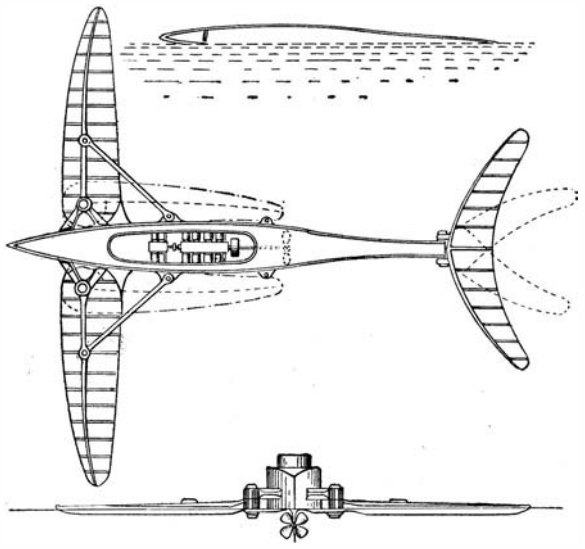
In 1872 Froude, at the request of the British Admiralty, experimented with planes sheathed with polished metal, variously grouped and inclined. As light and swift-running motors were not then to be had, the apparatus was towed. At high speeds there was a partial emergence, which sometimes amounted to half the displacement, and the resistance was found to increase less rapidly than the velocity.

M. Pictet also attacked the problem, not with inclined planes, but with constructions somewhat like the modern auto boats, which "glide on their sterns." The sides of his boat were parallel and vertical, while the profile of the bottom was a parabola with its vertex at the bow, and its concavity directed downward. The stern was vertical, and made an acute angle with the bottom. The boat was towed, and showed advantages over ordinary boats at all speeds exceeding 10 miles an hour. It rose perceptibly, the water flowing away in a smooth, connected sheet. Up to 15½ miles an hour the increase of power required was much less than with an ordinary boat, and at higher speeds the power decreased in absolute value. In some cases more than half the normal displacement was out of water.

M. Albert de Puydt has endeavored to make a boat glide over the water without appreciable displacement, by means of inclined planes, hydroplanes. It is calculated that 13 horse-power suffices to lift out of the water a boat weighing 1,300 pounds, with a hydroplane area of 100 square feet.

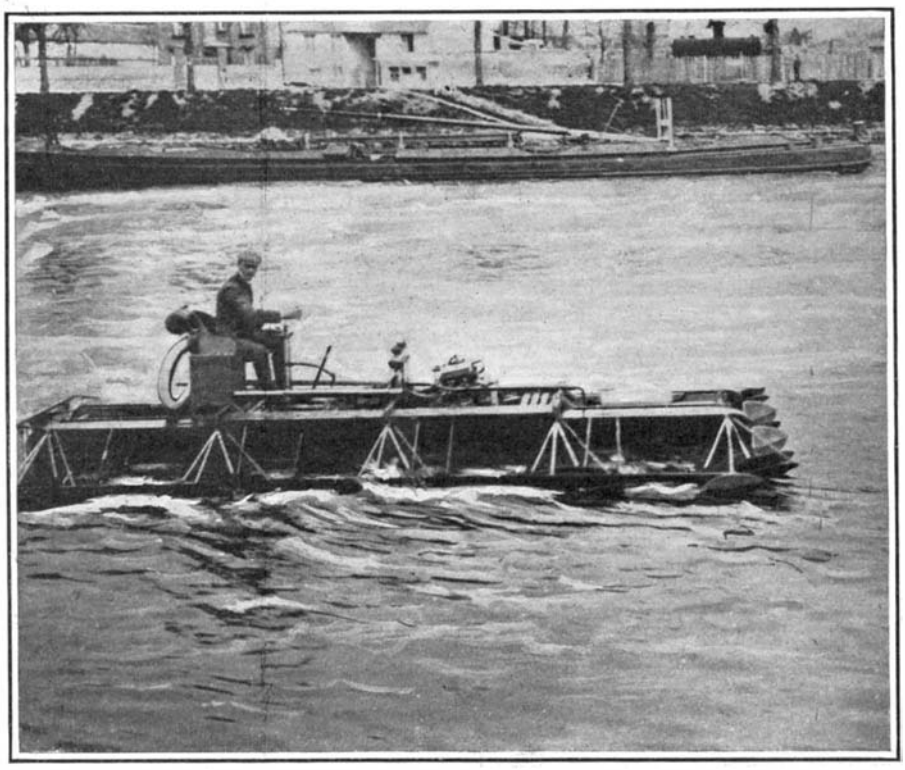


Pictet's Experimental Boat, with Lines of Flotation.



Designed to run on films of air forced out under the gliding runners.

Ader's Gliding Boat and Its Pneumatic Runners.



An Experimental Trip with Lambert's Boat.

Length, 20 feet. Breadth, 10 feet. Five gliding planes. Speed, 25 miles per hour. 12-horse-power motor.

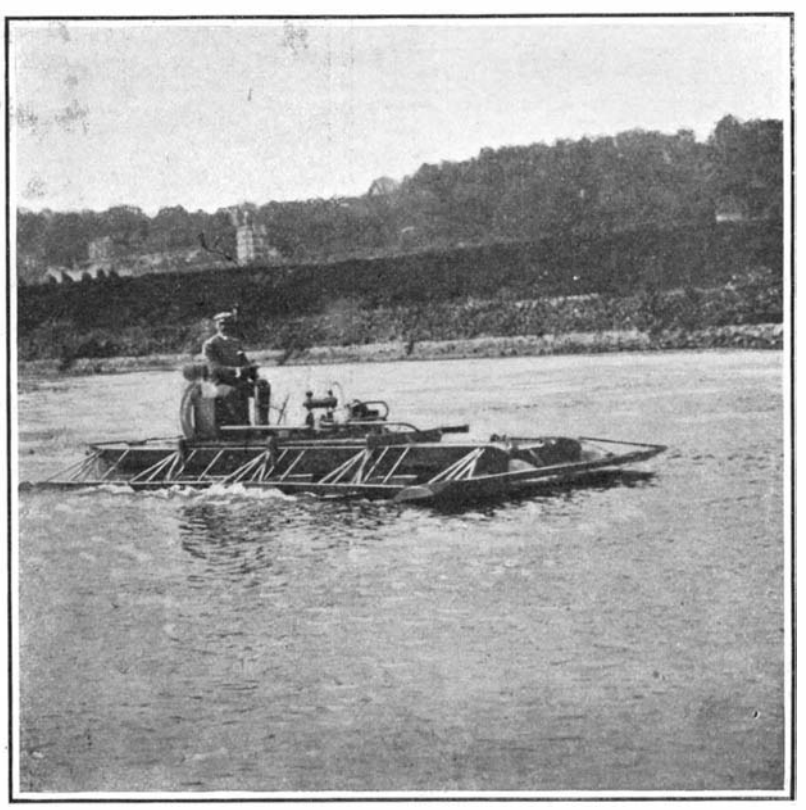
M. de Lambert, on the contrary, has built a series of practicable gliding boats. I have tried one of them, which carries two persons, and there would seem to be no difficulty in constructing much larger vessels. For years De Lambert has studied the application of the skipping-stone principle to navigation. He towed inclined planes with increasing speed until they suddenly rose to the surface, the power consumed falling as suddenly and remaining very small as long as the speed required for such gliding was maintained. The improvement of light-weight motors led him to equip his boat with one, which enabled it to move independently. In 1897 he mounted a compound Field motor with tubular boiler on a catamaran formed of two narrow hulls joined by a frame of metal tubes. The motor made 800 revolutions a minute. To the frame were attached, under the hulls, four transverse planes whose inclination to the horizon could be varied from 1 in 20 to 1 in 30. The boat weighed 600 pounds, and the combined area of the planes was 55 square feet. At speeds above 10 miles an hour the boat glided on the planes with the hulls entirely out of water. The maximum speed, 20 miles an hour, was remarkable for a grate surface of 74 square inches and a screw diameter of 18½ inches.

But a steam engine is not suited for a one-man boat, so an easily-managed petroleum automobile motor was used in subsequent experiments, in which increased speed was attained by modifying the arrangement and inclination of the planes. Count de Lambert's latest boat is 20 feet long and 10 feet wide between the ends of the planes, which are five in number. They are made of mahogany, I believe, and the inventor has built the entire boat of ordinary materials, to prove that the essential thing is not the material, but the arrangement of the planes. The two hulls are long and narrow, but this is merely to economize space, for they play no part in navigation at normal speed, when they are entirely out of water. The construction is very light, the frame consisting, in part, of aluminium tubes. The power is furnished by an ordinary automobile motor (Dion Bouton) of only 12 horse-power. The boat will carry two persons, but may be managed perfectly by one.

When the motor is started, the vessel moves forward a few yards, supported by the floating hulls, and the submerged planes plow the water. If this state of affairs should continue, great power would be required; but, from the beginning, the inclined planes tend to rise, and they emerge partially after a few yards' run. This causes a great diminution of resistance and, therefore, a sudden increase in speed, and the boat rises quickly until only the after parts of the planes dip in the water. This is the normal position. Indeed, as may be seen when the boat passes the observer, and, less clearly, in the photographs, the two forward planes seem not to touch the water, so that the boat glides partly on a layer of air or foam. It almost "skips" over the surface, with amazing speed, and without forming a bow or stern wave or the classical "furrow." The speed may well be called amazing, for it has risen to 25 miles an hour. This is the speed of the most perfectly designed auto boats with 80-horse-power motors, but De Lambert's boat, of equal weight, uses only 12 horse-power. The boat will carry two persons, but may be managed perfectly by one.

Such a boat easily accommodates a 40-horse-power motor, so that 27 horse-power remains for the forward motion. De Puydt's experiments, I think, have been confined almost entirely to a small model.

Lambert's Steam Glider, Model of 1897. Made 20 Miles per Hour.



Lambert's Gliding Boat at Speed. Hulls Lifted Clear of the Water.

GLIDING BOATS.—THE NAVIGATION OF THE FUTURE.

horse-power! This very remarkable result, I think, practically solves the problem of navigation by gliding. All that remains to do is to apply the principle on a larger scale.

M. Ader, also, has invented a very ingenious boat, which is now in the Paris Conservatoire des Arts et Métiers. It has, at the bow, two large wings and, at the stern, two small ones which form a sort of tail. The wings fold together lengthwise when not in use. To facilitate gliding, M. Ader conceived the idea (more ingenious than practical) of forcing compressed air into chambers formed between the concave wings and the surface of the water. There must be in this device a large consumption of power in the continual compression of air, to replace that which escapes as the boat advances.

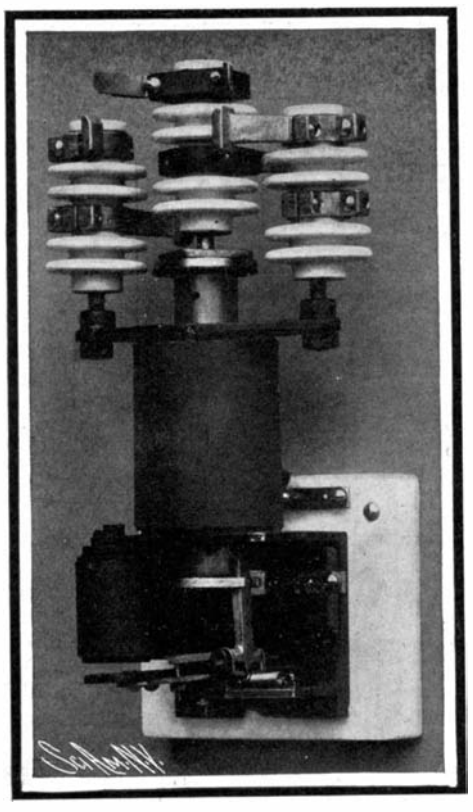
Count de Lambert's boat has stood the test of practice. In defiance of theoretical objections, it steers perfectly, and it can be stopped with the greatest facility, because, when the motor stops, the hulls fall back into the water and act as brakes. Pleasure boats of this type are sure to come into use quickly, and I cannot see why further study should not lead to the construction of larger vessels on the same principle.

AN AUTOMATIC SWITCH FOR MAKING AND BREAKING THE PRIMARY CIRCUIT OF TRANSFORMERS.

With transformers, it is important that, when the secondary current is started or interrupted, the primary circuit shall be simultaneously closed or opened. In fact, whatever may be the importance of the efficiency of a transformer, the annual efficiency of a transforming installation always leaves something to be desired if the periods of operation are interspersed with long periods of rest. This is due to the fact that the primary circuit always remains closed, and the current necessary for the magnetization continues to pass through it. It is in order to remedy this inconvenience that the Siemens-Schückert Company has for some time been employing the arrangement that we are about to describe with the aid of the accompanying diagram.

If, in the secondary circuit, the switch, A_2, is closed, a circuit is formed for the current from the batteries, *B*. This circuit includes the contact spring, k_4, and the electro-magnet, *s*. The latter becomes energized and attracts the armature, *a*. At the same time, the lever, *h*, which forms part of *a*, and the end of which sufficiently supports the sleeve, *H*, containing the iron core, *E*, will turn upon its axis, *O*, to move away from under the sleeve and allow it to drop and close the switch, A_1, of the primary high-tension circuit.

When the switch, A_2, is again thrown off, the contact, k_3, is closed, and the solenoid, *S*, will then be violently excited by the secondary alternating circuit. As a result of this, the core, *E*, is quickly drawn back into the coil, *S*. Hence, the sleeve, *H*, will be carried along and the high-tension switch, A_1, will be again opened. The interrupting arrangement cannot possibly fall back because the supporting lever, *h*, again moves into place beneath the sleeve, *H*. In the inoperative position, the electro-magnetic tele-interrupter is devoid of current, and therefore consumes no energy, besides being silent.



THE SIEMENS-SCHÜCKERT AUTOMATIC SWITCH FOR TRANSFORMERS.
The switch is shown in the open, or "off," position.

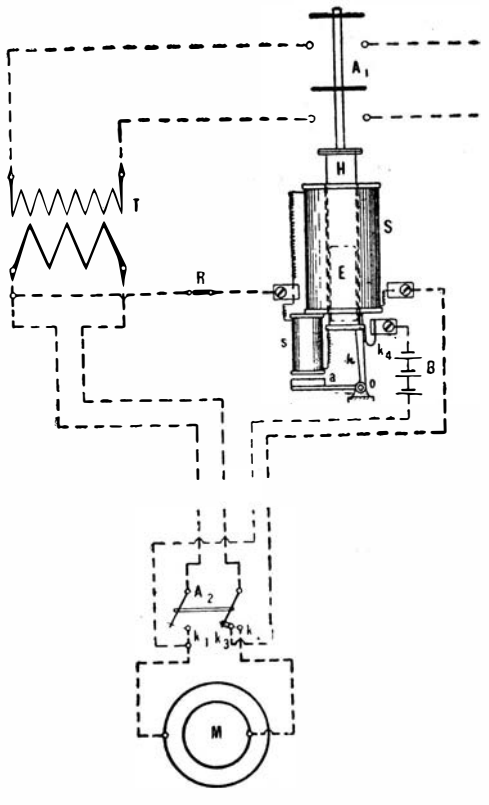


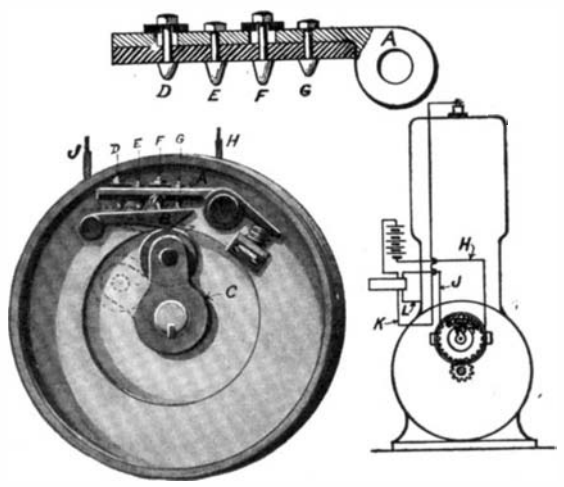
DIAGRAM OF WIRING OF SIEMENS-SCHÜCKERT AUTOMATIC SWITCH FOR TRANSFORMERS.

"Calcium Steel."

A novel material, likely to assume a high importance for the ceramical industries in case the statements made in regard to its properties are borne out even partially, is called "calcium steel." This product is obtained from feldspar sand and a lime flux and is a compact, homogeneous and plastic mass of great hardness, resisting oxidation and not affected by the influence of the atmosphere or of acids; it also is a poor conductor of heat and electricity. Its specific weight is 3.2, and its crushing strength about 2,500 kilogrammes per square centimeter. "Calcium steel" can be worked like a metal, and can be filed, bored, chiseled, polished, enameled, painted on, or otherwise decorated like glass and porcelain. For the manufacture of articles from this product two processes are available. After mixing the two components, viz., feldspar sand and lime, in the proper ratio and in a finely powdered condition, the mass can either be molded cold and compressed like bricks and the articles thus obtained heated up to the temperature required for the sintering of the components, or else the mass may be simply melted together and poured out like metal in molds after having become liquid. The cast articles would have to be carefully annealed and cooled slowly. "Calcium steel" is of a white color, but can be colored by the addition of metal oxides or the like. Its extremely favorable physical properties make it an extremely favorable material for water conduits, gas pipes, and other underground piping.

CIRCUIT-BREAKER FOR EXPLOSIVE ENGINES.

Something quite new in the line of circuit-breakers for explosive engines is provided by the recent invention of Mr. Ralph M. Lovejoy, of Meredith, N. H.



CIRCUIT-BREAKER FOR EXPLOSIVE ENGINES.

The improved mechanism avoids the uncertainties of a vibrator, insuring positive interruptions, and instead of a single, sudden break, a series of interruptions of high frequency are afforded. Furthermore, the arrangement is such as to keep the contact surfaces clean. The action of the mechanism and the course of the currents may be traced in the accompanying engraving. The contact lever, *A*, is provided with a number of contact posts adapted to make contact with the cam lever, *B*. The latter is formed with a cam swell, which is engaged by a roller on the crank arm, *C*. The posts, *D*, *E*, *F*, and *G*, on lever, *A*, are arranged to consecutively make contact with the lever, *B*, as will be presently explained. The primary circuit may be traced from the battery, through the primary winding of the induction coil and by way of wire *J*, direct to the lever, *B*, without passing through a vibrator. Thence it is conducted through lever, *A*, and wire, *H*, back to the negative pole of the battery. The secondary wires, *K* and *L*, lead respectively to the spark plug and the engine base. The crank arm, *C*, is revolved by suitable gearing with the main shaft of the engine. At each revolution of the crank arm the lever, *B*, will rock upward, raising the lever, *A*. The dotted lines show the normal positions of these two levers, with the post, *D*, resting on lever, *B*. By reference to the detail view of lever, *A*, it will be observed that the posts, *D* and *F*, are insulated from the lever, also that the posts, *E* and *F*, are longer than *D* and *G*, so that the posts terminate in an arc instead of a straight line. By reason of this arrangement, as the levers rise out of normal position the post, *E*, will first make contact with the lever, *B*, completing the primary circuit of the induction coil; then as the levers continue to rise this contact will be broken when post, *F*, engages the lever. Finally, when the levers are in their highest position, the primary circuit will be completed again through post, *G*. Then as the lever drops the circuit will be broken when *F* engages the lever, completed when *E* engages the lever, and finally broken when normal position is reached with post, *D*, engaging lever, *B*. A spring acting on the arm, *A*, insures perfect contact of the posts with this lever. Thus, every time the crank shaft operates the cam lever, three positive interruptions of the circuit are made. For the sake of simplicity, we have shown but four posts on the contact lever. However, it will be obvious that any desired number may be provided to increase the frequency of the interruptions. Owing to the fact that the two levers swing on opposite axes, there will evidently be some friction between the contact posts and the cam lever. This friction, while not enough to be objectionable, will serve to keep the contact points clean, insuring perfect electrical contacts.

Do We Require Teeth?

In a highly diverting discussion that followed the reading of a paper (published in full in a recent issue of the Journal of the American Medical Association) on "To What Extent are Teeth Necessary to Civilized Man?" Dr. Eugene L. Talbot made the startling assertion that dentistry, owing to uncleanliness in the insertion of bridges, etc., has as much to do with disease as any other one thing. He claims that the collection of germs about an ill-fitting crown is more detrimental to man than no teeth. For years Dr. Talbot has believed that man can get along without teeth. Men have lived to 90 to 100 years of age and have been without teeth for fifty or sixty years.

One assertion of the doctor is well calculated to arouse the apprehension of the reader. "Methods of preparing food to-day," says he, "do not require mastication and the jaws show in the evolution of man a shortening up, decay and loss of the teeth due to disease, and as evolution advances it will be seen that man can get along without teeth. Loss of the teeth due to interstitial gingivitis is a marked illustration of the fact that the teeth are passing."

"In regard to bacteria in the mouth," Dr. Talbot concluded, "there is no question that modern dentistry is doing more to injure the teeth and the alimentary canal than any one thing. The filthy condition of the mouth under bridges and crowns is certainly not conducive to health."

Dr. Frank L. Platt said that although it is possible for man to live without teeth, he did not think it a good plan for him to do so. He expressed himself as heartily opposed to the eating of prepared food that is easily digested, and opposed to vegetable food and health food because patients who have taken up this mode of living are all losing their teeth, show evidence of malnutrition, are anemic and miserable specimens of humanity. Teeth, Dr. Platt averred, were given us for a definite purpose; they should be maintained as long as possible, and if they are lost, they should be replaced.

Dr. G. V. I. Brown said that the animal economy gets along better with a good, full complement of teeth than it does without them. He declared that the mere fact that the chemist has prepared artificial food that can be digested without mastication is no argument against the use of teeth for masticating purposes. "They have been obliged to do this to help out the people without teeth or the people who are too lazy to use their teeth." Dr. Brown expressed his opposition to the idea that we can get along without teeth. "We can do it, but only with the greatest of care in the preparation of food."

Dr. M. I. Schamberg supported Dr. Talbot in the view that the time may come when people will be able to get along without teeth.

An interesting application of thermite (oxide of iron and alum) occurs in the production of castings free from air holes. For this purpose a mixture of thermite and titanium oxide is introduced in the melted mass. This causes an elevation of the temperature, and the titanium combines with the nitrogen of the air contained in the mixture, forming cyanides of titanium, which float on the surface as slag; at the same time oxygen combines with the iron, also forming slag. In this way the gases contained in the casting, and liable to form air holes, are eliminated. —Rev. des Prod. Chim.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

PROCESS FOR ELECTRICALLY WELDING RAIL-JOINTS.—C. PAHDE, Hohenzollernstrasse 63-65 Breslau, Germany. This is a process for welding rail-joints after the rails are placed in position upon the track, the object being to render the rails practically integral. A molding form is placed around the adjacent or abutting ends, an electric current is passed through the junction between the rails so as to partially melt these ends, and large bits of metal are gradually fed in between the ends, so as to fill up flush with the top, thus perfectly uniting the rails.

Of Interest to Farmers.

BALE-TIE.—D. WITT, Trenton, Ill. This bale-tie is intended for use in securing bales pressed in baling-presses and for other use. The invention provides at one end of the main wire a hook-like projection and a keeper-section twisted in connection, so that the section overlies the hook and the loop of the section may receive the hook in the fastened position of the parts, the end extension of the section beyond the loop passing through the eye on the other end of the tie and bearing below such eye while the eye is engaged with the projection, whose free end is within the loop of the keeper. The end extension of the keeper-section is made in form of an eye for convenient manipulation of the device and when disposed in a certain position locks the loop on the hook or projection.

CORN HARVESTER AND HUSKER.—P. FLEMING, Burton View, Ill. The aim of this inventor is to provide a machine which is adapted to enter a corn-field and to harvest or cut off the stalks of corn and at the same time strip the ears from the stalks, take the husk off the ear, and to save any shattered grains of corn which may be shelled off, all of the operations to be continuously performed by the draft of the team in drawing the machine across the field.

Of General Interest.

PROCESS OF MAKING PAINT-PIGMENTS.—J. A. TITZEL, SR., Newcastle, Pa. In this instance the invention relates to a process for producing a pigment or basis for making paints and preservative coatings admitting of general use, but specially applicable to surfaces of iron and steel, so as to preserve the same and especially to prevent the rusting thereof.

NAIL-CLAW. — L. JOLISSAINT, Terre-Blanche-Hérimoncourt, Doubs, France. This tool is to be used for the quick withdrawal of nails or tacks. Two nippers are presented to the nail head and slight pressure is exerted upon the wood, while the arms are brought nearer to each other, so as to cause the nippers to pass under the head. Then the tool is tilted to find a fulcrum on the wood by means of its heel portion, and in this way the nail can be very easily removed. Spacing of arms can be previously regulated by means of guides, according to diameter of head of the nails which are to be removed. Should nails be headless, the pressing of nippers against the bodies of the nails would be sufficient to allow of withdrawing these nails.

PORCELAIN TOOTH-FACING.—L. L. POSTON, Council Bluffs, Iowa. This improved dental attachment comprises a porcelain tooth having its back constructed in right-angular form, the vertical portion having a dovetail groove which extends down below the horizontal or shelf portion and terminates in a socket, and a right-angular plate having a rod secured to and extending below it, the plate and rod being fitted to the tooth proper and the rod being held in the groove and extending below the shelf into the pocket.

FLASH-BOARD FOR DAMS.—J. E. JENKINS, Vernon, N. Y. One purpose of the inventor is to provide an automatic board which will have a damming effect on the flow of water in all cases in which the surface of the water is below a certain maximum elevation, the board being of cylindrical construction and mounted to freely roll upon curved tracks engaging the board at its ends, and, if necessary, at points between its ends, which tracks have a maximum curvature at their upstream ends gradually increased in radius to a point near their outer or downstream ends, which latter parts are substantially straight and nearly horizontal.

BOOKCASE.—H. E. HUBBELL, Johnson, Vt. There is provision in this improvement for a series of shelves which may be raised to any desired height on a central post by means of pawl and ratchet mechanism. The shelves are circular and are mounted so that they can turn about the post to bring any desired book before the operator. The shelves are supported on ball-bearings to give perfect freedom of movement. The case is also adapted for holding merchandise or the like.

VAULT-MOLD.—T. F. GAEBLER, Rockville, Ind. Mr. Gaebler's invention has reference to a mold for manufacturing burial-vaults from plastic materials. The principal objects of his invention are the provision of means whereby burial-vaults can be made rapidly and economically and at the same time improve the structure and appearance of the vaults themselves.

DIE-STOCK. — J. J. DELEHANT, Chicago, Ill. In this instance the invention refers to improvements in stocks for thread-cutting dies, an object being to provide a die-stock with a simple means for quickly adjusting it to different sizes of pipes or rods on which a thread is to be cut and serving as a guide to cause a perfectly straight cut of the thread.

RETORT.—G. KETCHUM, Cutler, Ga. The retort comprises an outer and an inner casing, the former provided with upright guides on which the latter may slide when the lid of the outer casing is removed. The main steam inlet of the outer casing is surrounded with a step bearing which receives a nozzle on the inner shell making a steam-tight connection. A perforated steam distributing cone is fastened over the inlet of the inner shell.

MACHINE-GUN.—J. BOEGER, Dresden, Kan. This gun is adapted to be used with any form of cartridge. The effect of the discharge is very destructive. It is to be used on fortifications to oppose the storming of an enemy. It may also be used in trenches and on battleships. By having three or more cartridge-holders the loading and firing may be carried on so rapidly as to make the weapon one of great destructive power. None of the barrels are parallel; but all diverge, and the tiers of barrels are so divided and ranged as to perfectly cover a field five or six hundred feet wide at a range of fifteen hundred to two thousand yards, the shots placed at this distance two to two and one-half feet apart.

Household Utilities.

WASHTUB.—A. THOUROT, Union Hill, N. J. This non-leakable washtub is in single formation and provided with one or more compartments and constructed to be conveniently and expeditiously connected by bolts and nuts or their equivalents, the sections being so shaped as to receive and hold an outer covering of cement or other plastic material, which effectually conceals all connecting mediums and completely closes all interstices or joints. It can be transported in sections and readily set up.

Machines and Mechanical Devices.

WHEEL-STRAIGHTENING MACHINE.—J. S. MAYSE, Brady, Texas. The improvement relates to means for straightening light or heavy wagon-wheels when the spokes become loosened and the wheel is excessively dished, and the object is to provide details of construction which enable the quick and convenient straightening in a perfect manner, for the removal of an excess of dish or concavity from either side of the wheel, and the straightening of vehicle-wheels having either wooden or flanged metal hubs and either metal or wooden spokes, and facilitate the removal and resetting of the tire on the rim of a wheel that has been straightened on the improved machine.

Railways and Their Accessories.

RAILWAY-SWITCH.—C. E. KLING, Harrisburg, Pa. The purpose of this improver is to provide a construction of switch in which the main line is always open and wherein when it is desired to pass to a siding the switch can be set from the engine-cab and locked in such position until the entire train has passed upon the siding, whereupon the switch will be automatically returned to its position for the main line, the operation being the same when a train is to pass from a siding to the main line, with the exception that the operation at such time is entirely automatic.

Pertaining to Vehicles.

ROLLER-BEARING.—R. F. BOWER, Lima, Ohio. In this case the invention is an improvement in anti-friction-bearings. The invention may be employed in vehicles, automobiles, machinery, roller journal-bearings, line and propeller shafting or otherwise wherever desirable. An alternating arrangement of the rollers operates to space the cylindrical portions of the rollers apart and reduces the friction in the use of the improvement. The ball is an integral rigid part of the roller.

UNICYCLE.—J. MATTSON, Anaconda, Mont. Mr. Mattson provides a vehicle to which ready access may be had from either side. The steering devices are used only when the lateral wheels are upon the ground. The parts are so distributed relatively to each other as to effect a thorough balancing thereof, thus tending to equilibrium thereof in operation. By operating either one of the particular hand-levers the operator may readily control any part of the machine. It may be driven by either mechanical or electrical power.

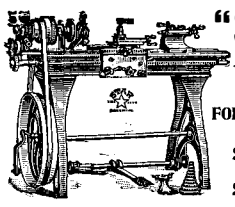
BRICK-TRUCK.—C. M. STEELE, Statesville, N. C. Provision is made in this patent for a novel construction of truck including interchangeable frames, one for handling portable hacks and the other for handling pallets in racks. In operation the handle-levers operate upon the rocking arms in such manner as to lift an adjustable-frame and a lifting-frame in the operation of the handle-levers. Brace-rods are so connected that the handle-lever has to draw the lifting-frame back far enough to balance the load in lifting the arms of the main frame.

MOTOR-STARTER.—C. E. ASBURY, Jeffersonville, Ind. The invention refers particularly to improvements in devices for starting combustion-motors on automobiles or similar vehicles. The main object of the invention is to provide in connection with the spring-actuated starting device a simple means for disposing working parts of the device so as to prevent the danger of "kicking-back."

Designs.

DESIGN FOR A PERCOLATOR-HANDLE.—H. NUTRIZIO, New York, N. Y. The handle is unique and well adapted for the purpose intended; it is readily accessible when applied to a percolator, enabling the latter to be conveniently manipulated and offers no obstruction to the cover for the pot, and does not detract from the appearance of the vessel.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



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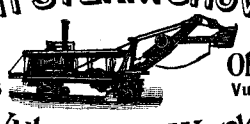
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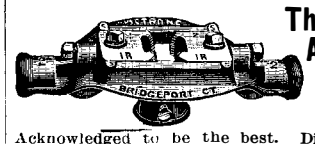

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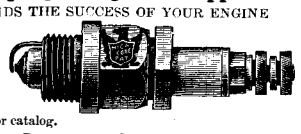
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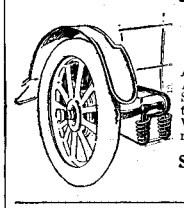
N. Y. Representatives, Auto Supply Co., 1662 Broadway, N. Y. City.



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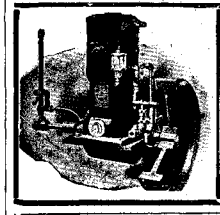

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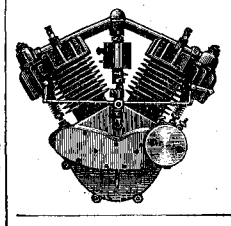

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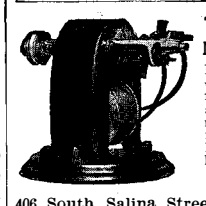

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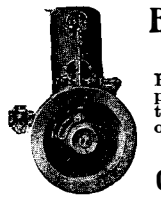

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Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7314.—For dealers in initiatory outfits for lodge work.

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Inquiry No. 7315.—Wanted, name of mill rolling very light steel belting 8 inches to 32 inches wide, and flexible enough to work over pulleys 5 inches diameter

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 7316.—For parties to make thin and concaved razor blades.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7317.—Wanted, a company to install a gas plant for light and fuel purposes, in town of about 1,500 population, compactly built up, the entire corporation being only one mile square.

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Inquiry No. 7318.—For manufacturers of non-conducting cement for use in electric heater work to hold resistance wires in place.

WANTED.—Patented specialties of merit, to manufacture and market. Power Specialty Co., Detroit, Mich.

Inquiry No. 7319.—For makers of school rulers.

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Inquiry No. 7320.—For makers of gas, gasoline and storage battery motor of ¼ or ⅛ h. p.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7321.—Wanted, the name and address of the makers of the "Aeriola" piano player.

Mechanical devices of brass, aluminum, and kindred metals manufactured for inventors and patentees, and marketed on royalty, when desired. Imperial Brass Mfg. Co., 241 So. Jefferson St., Chicago, Ill.

Inquiry No. 7322.—Wanted, makers of channel iron 1¼ x 1¼ x ⅛ inches.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 7323.—For makers of bicycle railroad attachments, also small iron hand cars for one man's use.

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Inquiry No. 7324.—Wanted, machinery for making old carpets into rugs.

Manufacturers of all kinds sheet metal goods. Vending, gum and chocolate, matches, cigars and cigarettes, amusement machines, made of pressed steel. Send samples. N. Y. Dieand Model Works, 508 Pearl St., N.Y.

Inquiry No. 7325.—Wanted, an air pump to give sufficient air to a diver in from 5 to 20 feet of water.

FOR SALE.—Complete sets of patterns for manufacturing Strowbridge Seeders, Fanning Mills, Hand Corn Shellers. Write Hawkeye Incubator Co., Newton, Ia.

Inquiry No. 7326.—Wanted, parties building wire tapering machines, or to taper wire blanks in quantities, size wanted 1½ inches long, tapering from 1-16 inch to 1-64 inch diameter.

Inquiry No. 7327.—Wanted, address of agents or makers of "Cantbendem" pins.

Inquiry No. 7328.—For makers of fine composition castings, in quantities, for small gears and other parts of small machinery.

Inquiry No. 7329.—For makers of machines or looms for making shoestrings.

Inquiry No. 7330.—For makers of celluloid.

Inquiry No. 7331.—Wanted, machinery for extracting oil from castor beans.

Inquiry No. 7332.—For manufacturers of castings of stationary and marine gas engines.

Inquiry No. 7333.—For makers of dog power tread mills.

Inquiry No. 7334.—For makers of metal acetylene gas burners.

Inquiry No. 7335.—For makers of small 1 h. p. motors.

Inquiry No. 7336.—For makers of china kilns for firing hand-painted china.

Inquiry No. 7337.—For makers of wireless telegraphic outfits.

Inquiry No. 7338.—For manufacturers of feather-stripping machines.

Inquiry No. 7339.—For makers of grass goods, such as gasoline needle valves, burners, etc.

Inquiry No. 7340.—Wanted, a machine for sealing and attaching postage stamps to about 8,000 envelopes per hour.

Inquiry No. 7341.—For makers of clocks for registering the arrival of pigeons at end of race.

Inquiry No. 7342.—Wanted, makers of machinery used in the oil industry.

Inquiry No. 7343.—For dealers in cloth of jute heavier than the ordinary bagging, and closer than the cloths for pressing tankage.

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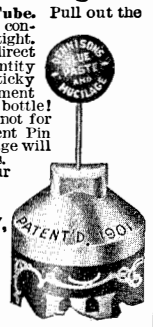

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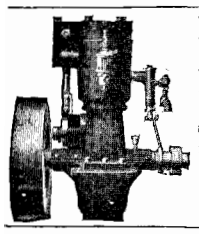

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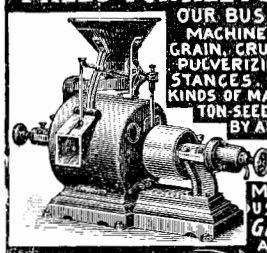

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9802) P. D. R. asks how to preserve tomatoes. A. Take the best, firmest, and not over-ripe fruit, scald and skin carefully, take the stem out with a penknife, being careful not to cut the tomato and let the juice out; place in a jar, some with the stem and some with the flower end next to the glass. Cook some juice, adding a little salt, and pour over the whole tomatoes until the jar is nearly full. Place the jars in a common fish boiler of oblong shape, with a cloth at the bottom to protect them from the heat of the fire, which is liable to crack them. Fill the boiler with cold water and bring to nearly boiling point, or sufficient to heat the tomatoes clear through, and seal the jars. In about five minutes take off the jar cover to let gas out and allow the tomatoes to settle; then fill up with boiled juice and seal again. Next day screw the tops tight and put away in a dark, cool place.

(9803) A. F. C. asks for the time required to digest different foods. A. The Monitor de la Salud contains in a recent number the results of some experiments lately made by E. Jessen on the time required for the digestion of certain kinds of food. The stomach of the person on whom the experiments were made was emptied by means of a pump; 100 grammes, equal to 1,544 grains, or about 2 2-3 ounces, of meat, finely chopped and mixed with three times the quantity of water, were introduced. The experiment was considered ended when the matter, on removal by the pump, was found to contain no muscular fiber. It will be remembered that the gramme weighs nearly 15½ grains, and the cubic centigramme is equal to 1 gramme. The 2 2-3 ounces of meat were therefore mixed with nearly eight ounces of water, before being introduced into the stomach. The results were as follows: Beef, raw, and finely chopped, 2 hours; beef, half cooked, 2½ hours; beef, well cooked, 3 hours; beef, slightly roasted, 3 hours; beef, well roasted, 4 hours; mutton, raw, 2 hours; veal, 2½ hours; pork, 3 hours. The digestibility of milk was examined in the same way. The quantity used was regulated so that the nitrogen should be the same as in the 100 grammes of beef. 602 cubic centimeters, nearly sixteen ounces, of cow's milk, not boiled, required 3½ hours; 602 c. c., boiled, 4 hours; 602 c. c., sour, 3½ hours; 675 c. c., skimmed, 3½ hours; 656 c. c., goat's milk, not boiled, 3½ hours.

(9804) W. W. L. says: In your reply to Question 9756 you say that "In a vacuum it is literally true that a mote and a cannon ball would fall equally fast; but not so in the air." In explanation of this, you say that "The actual velocity of fall is dependent upon the ratio of the weight of the body to that of the air it displaces." Now, before I can understand this explanation, I must ask that you answer for me this question: "What is weight?" The dictionary says that weight is "The measure of gravity," and I have always understood that weight is caused by gravitation, and that without gravitation there would be no weight. Now if gravitation causes weight, and gravitation affects all articles in proportion to their magnitude, why do not all articles of the same magnitude have the same weight? If air has any weight, it must be caused by gravitation, and if so, why does not a cubic foot of air have the same weight as a cubic foot of water, or of anything else? In other words, why does not any body have the same weight as the amount of air it displaces, in which case you say it could never fall to the ground? An answer to this would be very much appreciated. A. It is quite true that gravity is the cause of weight as we know it on the earth. But it is equally true that the weight of any body is determined by the quantity of matter it contains. A pail full of melted lead does not weigh the same as the same pail full of water. No one can think that. Yet the two have the same magnitude or bulk. To use your illustration, a cubic foot of air does not weigh the same as a cubic foot of water because it does not contain the same amount of matter. It contains about one eight-hundredth part as much matter as a cubic foot of water contains, and weighs about one eight-hundredth part as much. You seem entirely to overlook the essential feature of weight, namely, the quantity of matter which is weighed. If you take the same quantity of several substances, say one cubic inch, and

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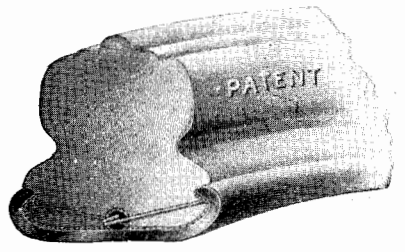

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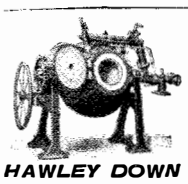

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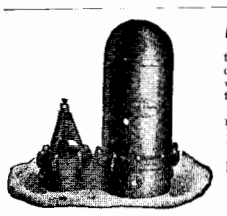

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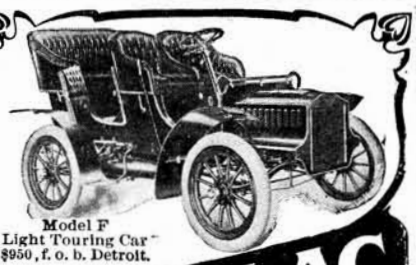

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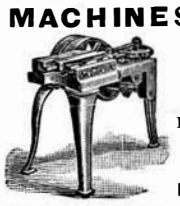

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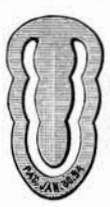

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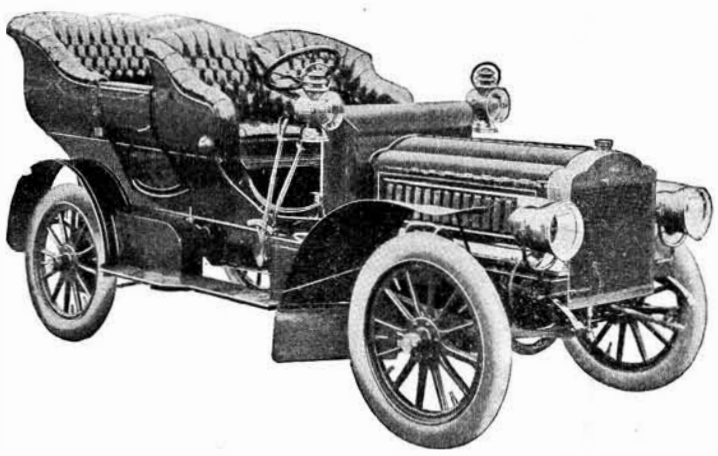

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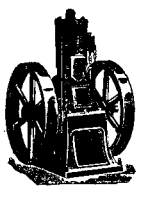

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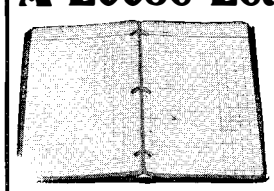

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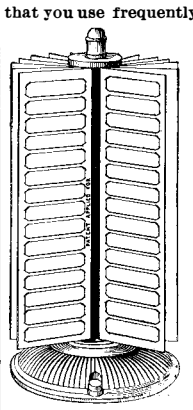

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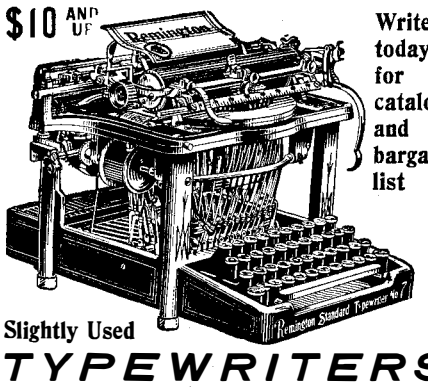

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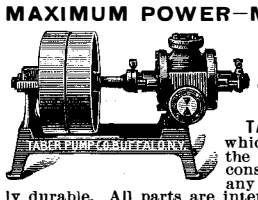

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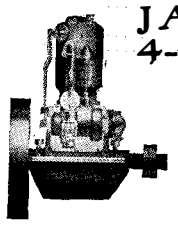

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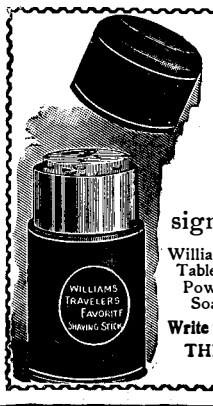

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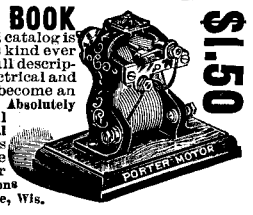

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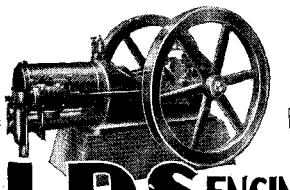

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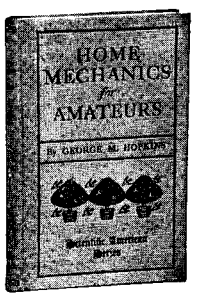

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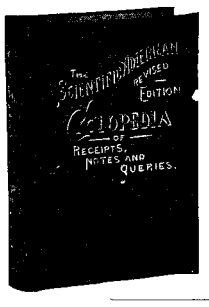

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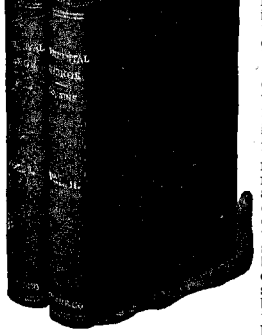

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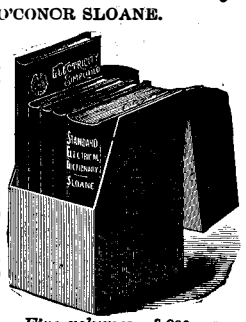

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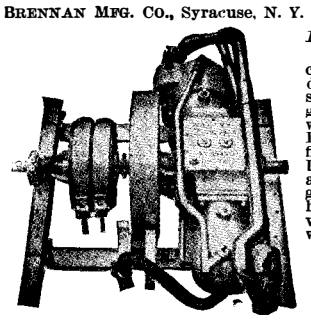

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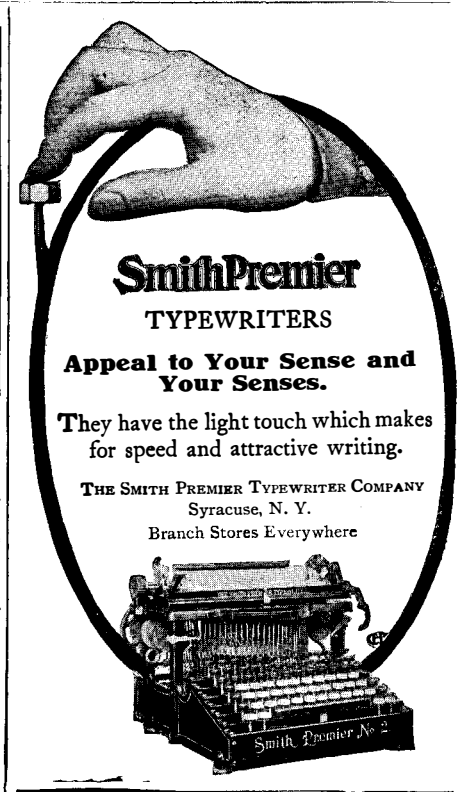

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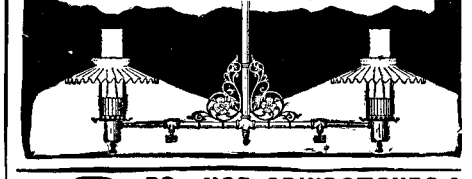

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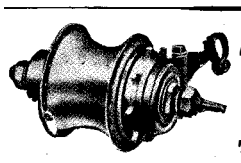

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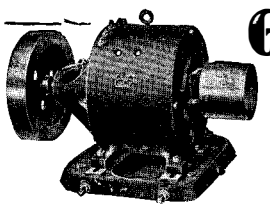

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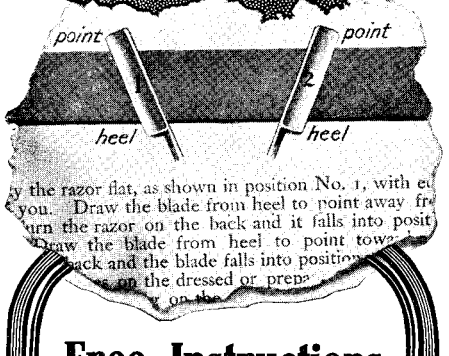

...y the razor flat, as shown in position No. 1, with ed... you. Draw the blade from heel to point away fr... urn the razor on the back and it falls into posit... Draw the blade from heel to point towa... back and the blade falls into positio... on the dressed or prepa... on the...

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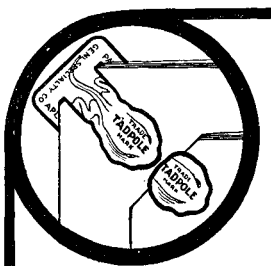

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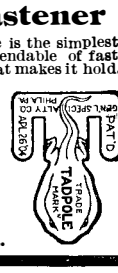

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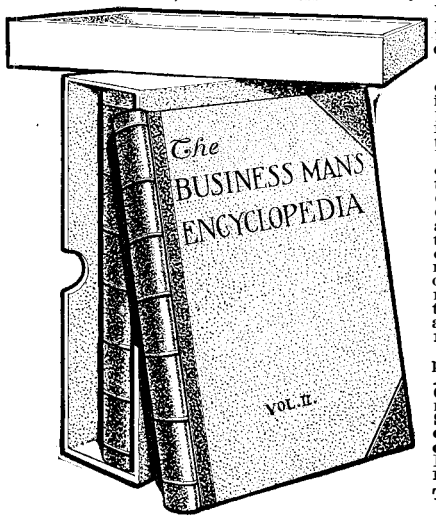

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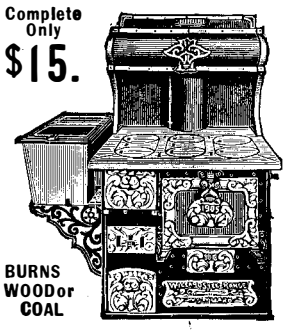

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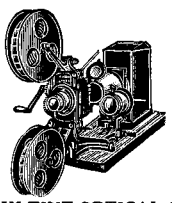

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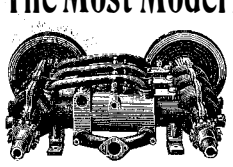

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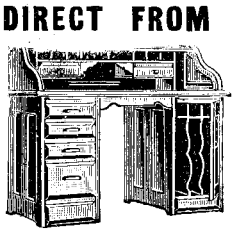

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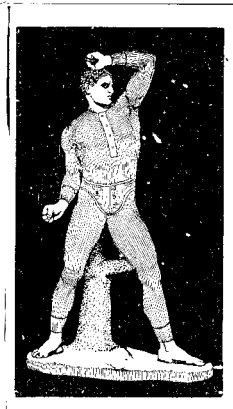

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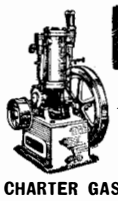

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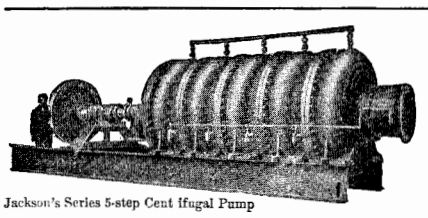

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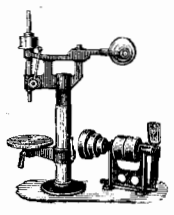

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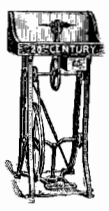

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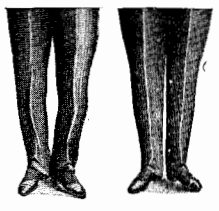

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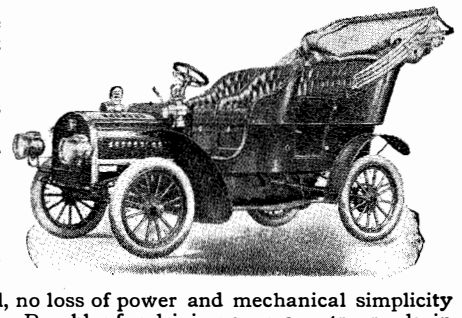

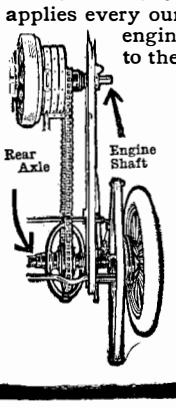

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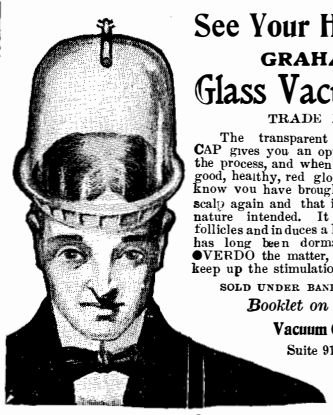

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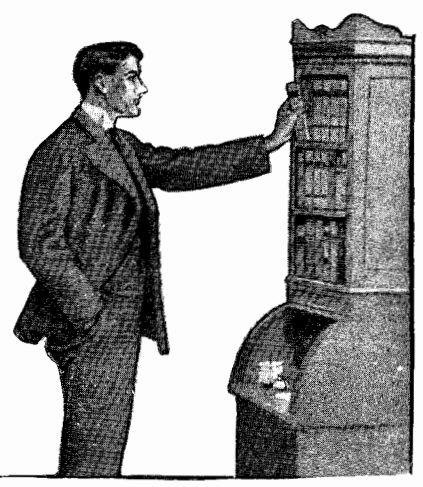

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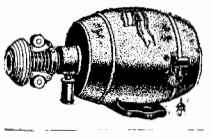

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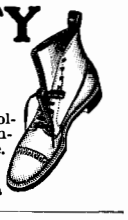

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